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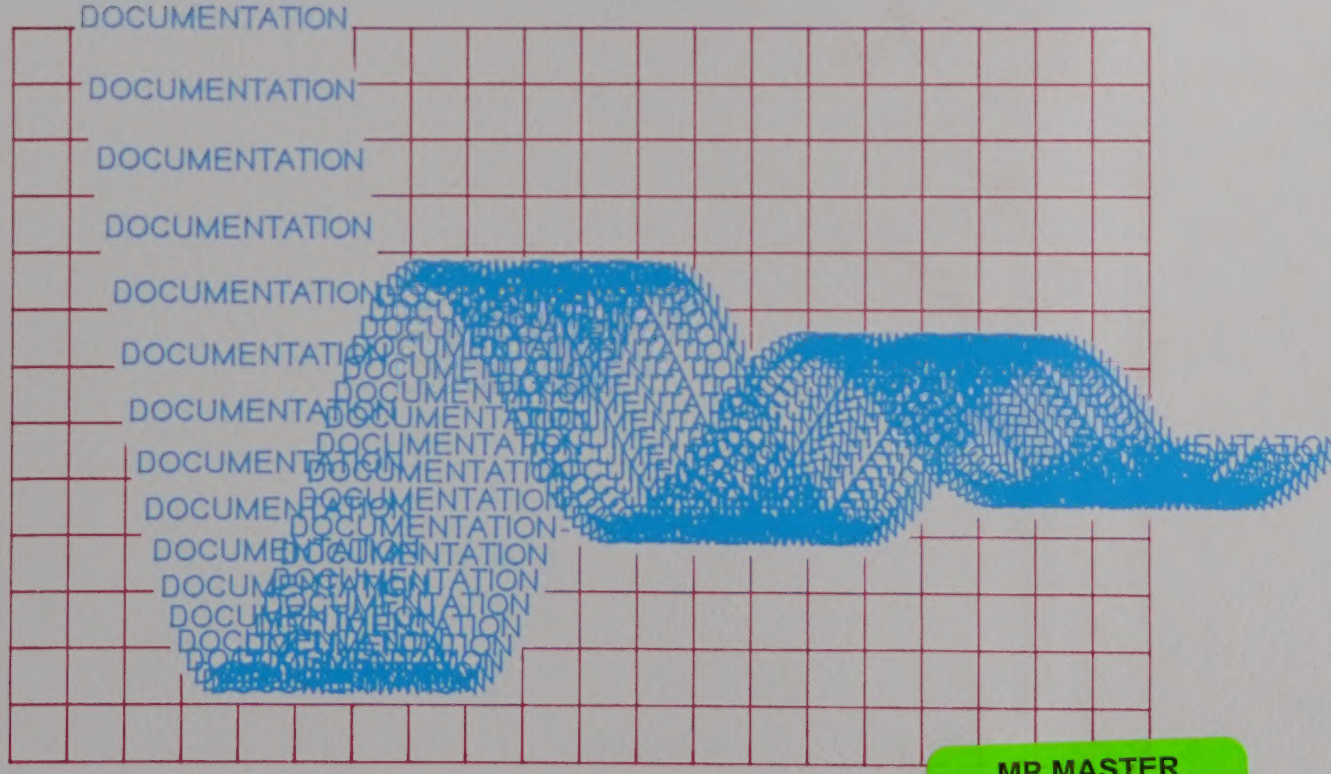

MP MASTER
MA20675

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Test and Measurement
Division

Software Manual

FM Measurement Demodulator for FSP

FS-K7

1141.1796.02

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FM Measurement Demodulator FS-K7

for Spectrum Analyzer FSP

FM Measurement Demodulator for Spectrum Analyzer FSP for determining analog modulation parameters.

Display

- Frequency modulation (FM) or carrier power as a function of time
- RF spectrum (FFT)
- Table with numeric values for peak and RMS deviation, modulation frequency (AF), carrier offset, carrier power

Features

- Digital measurement demodulator with wide bandwidth range from 12.5 kHz to 10 MHz
- Restoration of sampled signal with high measurement accuracy
- Ideal for production and development of *Bluetooth*™ modules
- Great memory depth for long measurement sequences (I/Q memory 2x 128 ksamples)

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FSP as FM Measurement Demodulator

Characteristics

Option FS-K7 adds FM demodulation to the functions of Spectrum Analyzer FSP.

The universal characteristics of the digital measurement demodulator open up a wide range of applications, e.g. measurements of synthesizer settling or frequency deviation. This makes FSP with option FS-K7 ideal for measuring modulation characteristics such as those required in the development and production of *Bluetooth* modules.

The measurement results can be subsequently displayed as

- Frequency (FM) or carrier power versus time or as an
- RF spectrum (FFT)

The main modulation parameters such as frequency deviation (peak, RMS), modulation frequency or carrier power are also numerically indicated in a table.

The sampled signal is restored and the signal is displayed in its original form. The sampling rate is automatically matched to the demodulation bandwidth.

Sequences with a length of up to 8.3 s (demodulation bandwidth 12.5 kHz) or 65 ms (demodulation bandwidth 1.6 MHz) can be recorded in the large I/Q memory of the FSP. This allows long bit sequences, such as occur with *Bluetooth* signals, to be completely investigated. The demodulated data can also be read out via GPIB, RS-232-C or LAN and processed on an external PC.

The FM and RF level trigger function with a wide dynamic range provides special trigger capabilities. This also allows signals to be tested for which no external trigger signal is available.

Measurement examples

***Bluetooth* modulation characteristics**
The frequency deviation of the signal is determined for a specified bit sequence (...1111 0000...or 10101010...) and displayed as a measured trace and in numerical form. (Fig. 1)

Transient response of synthesizer
With the FM measurement demodulator function, the transient response of a synthesizer can be measured in digital communication systems like GSM or *Bluetooth* transmitters. (Fig. 2)

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ISO 14001
REG. NO 1954

Certified Quality System
ISO 9001
DQS REG. NO 1954

ETSI MEMBER
...making the right connections.

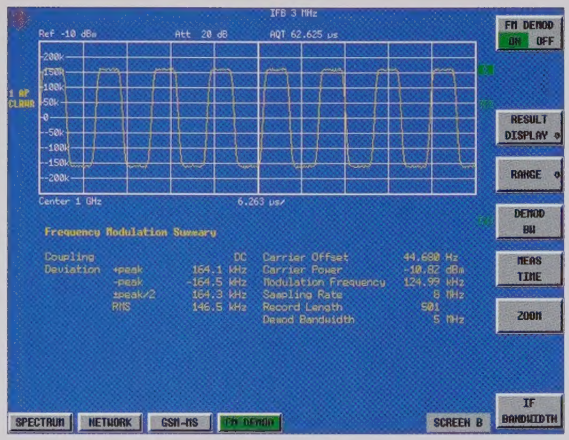

Fig. 1: Modulation characteristics of a *Bluetooth* signal

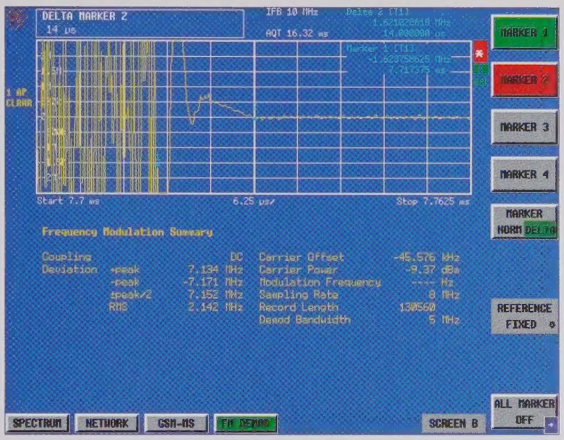

Fig. 2: Transient response of synthesizer

Specifications

Measurement of analog modulation signals

Demodulation bandwidth	12.5 kHz to 10 MHz
Max. record time	
Demod. bandw. ≤1.6 MHz	≥85 s/(demod. bandwidth/kHz)
Demod. bandw. > 1.6 MHz	≥34 s/(demod. bandwidth/kHz)
Readout	trace with frequency or RF power versus time, RF spectrum and table with numerical display of: peak and rms values of deviation, modulation frequency, carrier offset, carrier power (power of unmodulated carrier)

Frequency demodulation

AF	DC to 5 MHz (max. 0.5 x demod. bandwidth)
Deviation range	5 MHz (max. 0.5 x demod. bandwidth)
Deviation uncertainty	
AF + dev. ≤0.5 x demod. bandw. and AF ≤0.1 x IF bandwidth	<3% of result + residual FM

Residual FM [1)]

Demodulation bandwidth ≤200 kHz, rms

RF ≤1 GHz	80 Hz, typ.
RF >1 GHz	80 Hz x √(f/1 GHz), typ.

1) RF input level ≥(reference level/dBm –10) dBm and RF input level ≥(RF attenuation/dB –30) dBm.

Carrier power versus time

AF	DC to 5 MHz (max. 0.5 x demod. bandwidth)
Display range	noise floor to +30dBm
Max. dynamic range	
Demod. bandwidth 200 kHz	75 dB, typ.
Display nonlinearity	
S/N >16 dB	0.2 dB, typ.
Incidental AM with FM	
AF + dev. ≤0.5 x demod. bandw. and deviation ≤0.1 x IF bandwidth	0.1dB + residual AM, typ.

Unmodulated carrier power

Measurement uncertainty	
S/N >16 dB, RF=50 kHz to 3 GHz	1 dB, typ.

AF

Range	≤5 MHz (max. 0.5 x demod. bandwidth)
Resolution	5 digits
Uncertainty	0,1 %

RF spectrum

Span	12.5 kHz to 10 MHz
Resolution bandwidth (FFT filters)	1 Hz to 10 MHz
Shape factor 60:3 dB	2.5 nominal

Ordering information

FM Measurement Demodulator for FSP	FS-K7	1141.1796.02

Printed in Germany 0501.

PD 757.[illegible]21 · FM Measurement Demodulator FS-K7 · Trade names are trademarks of the owners · Subject to change · Data without tol[illegible]ss: typical values

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Telephone +49 89 4129-0 · www.rohde-schwarz.com · CustomerSupport: Tel. +49 1805 124242, Fax +49 89 4129-13777, E-mail: CustomerSupport@rohde-schwarz.com

Safety Instructions

This unit has been designed and tested in accordance with the EC Certificate of Conformity and has left the manufacturer's plant in a condition fully complying with safety standards.

To maintain this condition and to ensure safe operation, the user must observe all instructions and warnings given in this operating manual.

Safety-related symbols used on equipment and documentation from R&S:

Observe operating instructions

Weight indication for units >18 kg

PE terminal

Ground terminal

Danger! Shock hazard

Warning! Hot surfaces

Ground

Attention! Electrostatic sensitive devices require special care

1. The unit may be used only in the operating conditions and positions specified by the manufacturer. Unless otherwise agreed, the following applies to R&S products:

   IP degree of protection 2X, pollution severity 2 overvoltage category 2, only for indoor use, altitude max. 2000 m.

   The unit may be operated only from supply networks fused with max. 16 A.

   Unless specified otherwise in the data sheet, a tolerance of ±10% shall apply to the nominal voltage and of ±5% to the nominal frequency.

2. For measurements in circuits with voltages V_{rms} > 30 V, suitable measures should be taken to avoid any hazards.

   (using, for example, appropriate measuring equipment, fusing, current limiting, electrical separation, insulation).

3. If the unit is to be permanently wired, the PE terminal of the unit must first be connected to the PE conductor on site before any other connections are made. Installation and cabling of the unit to be performed only by qualified technical personnel.

4. For permanently installed units without built-in fuses, circuit breakers or similar protective devices, the supply circuit must be fused such as to provide suitable protection for the users and equipment.

5. Prior to switching on the unit, it must be ensured that the nominal voltage set on the unit matches the nominal voltage of the AC supply network.

   If a different voltage is to be set, the power fuse of the unit may have to be changed accordingly.

6. Units of protection class I with disconnectible AC supply cable and appliance connector may be operated only from a power socket with earthing contact and with the PE conductor connected.

7. It is not permissible to interrupt the PE conductor intentionally, neither in the incoming cable nor on the unit itself as this may cause the unit to become electrically hazardous.

   Any extension lines or multiple socket outlets used must be checked for compliance with relevant safety standards at regular intervals.

8. If the unit has no power switch for disconnection from the AC supply, the plug of the connecting cable is regarded as the disconnecting device. In such cases it must be ensured that the power plug is easily reachable and accessible at all times (length of connecting cable approx. 2 m). Functional or electronic switches are not suitable for providing disconnection from the AC supply.

   If units without power switches are integrated in racks or systems, a disconnecting device must be provided at system level.

9. Applicable local or national safety regulations and rules for the prevention of accidents must be observed in all work performed.

   Prior to performing any work on the unit or opening the unit, the latter must be disconnected from the supply network.

   Any adjustments, replacements of parts, maintenance or repair may be carried out only by authorized R&S technical personnel.

   Only original parts may be used for replacing parts relevant to safety (eg power switches, power transformers, fuses). A safety test must be performed after each replacement of parts relevant to safety.

   (visual inspection, PE conductor test, insulation-resistance, leakage-current measurement, functional test).

continued overleaf

10. Ensure that the connections with information technology equipment comply with IEC950 / EN60950.
11. Lithium batteries must not be exposed to high temperatures or fire.

    Keep batteries away from children.

    If the battery is replaced improperly, there is danger of explosion. Only replace the battery by R&S type (see spare part list).

    Lithium batteries are suitable for environmentally-friendly disposal or specialized recycling. Dispose them into appropriate containers, only.

    Do not short-circuit the battery.
12. Equipment returned or sent in for repair must be packed in the original packing or in packing with electrostatic and mechanical protection.
13. Electrostatics via the connectors may damage the equipment. For the safe handling and operation of the equipment, appropriate measures against electrostatics should be implemented.
14. The outside of the instrument is suitably cleaned using a soft, lint-free dustcloth. Never use solvents such as thinners, acetone and similar things, as they may damage the front panel labeling or plastic parts.
15. Any additional safety instructions given in this manual are also to be observed.

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1 Introduction

The following chapters describe the new operating functions of the FM demodulator option for Spectrum Analyzer FSP. In the case of functions identical to those of the base unit, reference is made to the relevant chapter in the base unit manual.

The digital signal processing in FSP, used in the analyzer mode for digital IF filters, is also ideally suited for demodulating FM or AM signals.

By sampling (digitization) already at the IF and digital downconversion to the baseband (I/Q), the demodulator achieves maximum accuracy and temperature stability. There is no evidence of typical errors of an analog downconversion and demodulation like AM ⇔ FM conversion, deviation error, frequency response or frequency drift at DC coupling. Only the characteristics of the analog IF filter ahead of the A/D converter need to be taken into consideration.

Circuit Description - Block Diagrams

Fig 1-1 Block diagram of analyzer signal processing shows the analyzer's hardware from the IF to the processor. The IF filter is the resolution filter of the spectrum analyzer, with a bandwidth range from 300 kHz to 10 MHz. The A/D converter samples the IF (20.4 MHz) at 32 MHz.

Lowpass filtering and reduction of the sampling rate follow the downconversion to the complex baseband. The decimation depends on the selected demodulation bandwidth. The output sampling rate is set in powers of 2 between 15.625 kHz and 32 MHz. Useless oversampling at narrow bandwidths is avoided, saving computing time and increasing the maximum recording time.

The I/Q data is stored in memories each comprising 128 k words. The hardware triggering (external, IF power) controls the memory.

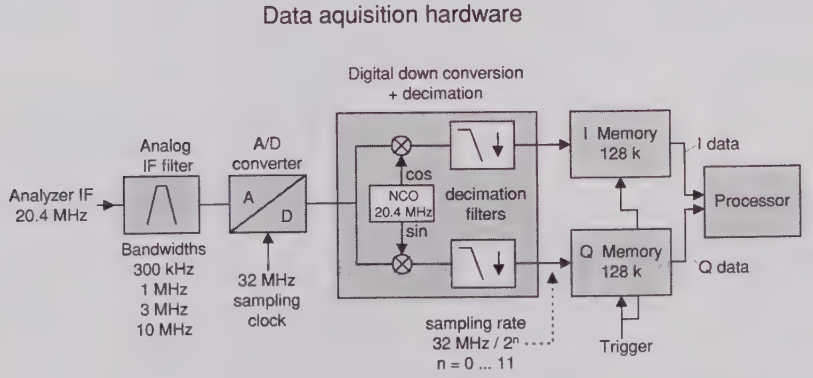

Fig 1-1 Block diagram of analyzer signal processing

The software demodulator runs on the main processor of the analyzer. The demodulation process is shown in Fig 1-2 Block diagram of software demodulator. All calculations are performed simultaneously with the same I/Q data set. Magnitude (= amplitude) and phase of the complex I/Q pairs are determined. The frequency result is obtained from the differential phase.

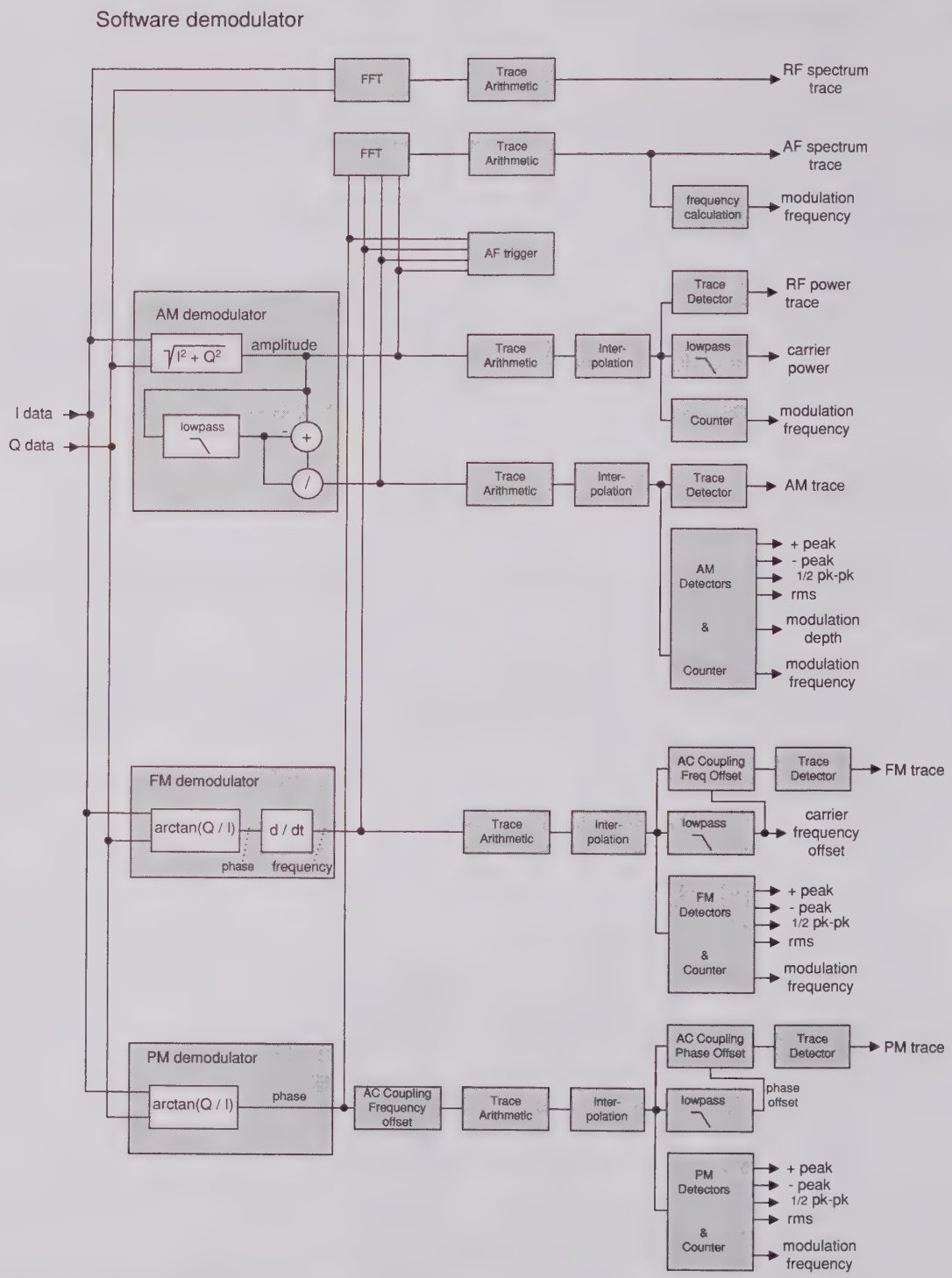

Fig 1-2 Block diagram of software demodulator

The AM-DC, PM-DC and FM-DC raw data of the demodulators is fed into the **trace arithmetic** block that combines consecutive data sets. Possible functions are: Clear Write, Max Hold, Min Hold and Average. The output data of the trace arithmetic can be read via **GPIB**. The recording length corresponds to the selected sampling rate of 1 to 128 k samples.

501 samples are required for on-screen display. If less data is recorded, the missing intermediate values are calculated by an **interpolation filter**.

If more than 501 samples are recorded, the interpolator becomes ineffective. In this case the **trace detector** reduces the number of samples to 501.

The trace detector combines several samples according to the functions selectable: Sample, Max Peak, Min Peak, Average, Autopeak, RMS. The **zoom** function does not combine any samples, but selects a sequence of 501 samples from the data set.

The data from the trace detector is displayed on the screen and can be read out via GPIB. They display level, phase versus time and/or frequency versus time.
In addition, important parameters are calculated:

- A **counter** determines the **modulation frequency** for AM, PM and FM.
- A **lowpass filter** suppresses the modulation frequency; the result is the average power = **carrier power** with AM and the average frequency = **carrier frequency offset** with FM. The deviation from the selected center frequency is displayed.
- **AC coupling** is possible with FM and PM display. To this end, the carrier frequency offset is subtracted from the FM DC data. In addition, the **frequency deviation** is determined from the trace data. +Peak, -Peak, ½ Peak-Peak and RMS are displayed.

Besides the demodulators, the spectrum of the I/Q data, the FM, the PM or the AM is calculated using **FFT**. The spectrum always comprises 501 samples.

Further Characteristics

IF Bandwidth

The **analog IF filter** improves the selectivity, but also causes signal distortions. The filter is negligible if:

IF bandwidth ≥ 10 x (modulation frequency + frequency deviation)

Note: *IF bandwidths ≤ 3 MHz ensure sufficient image-frequency rejection.*
If due to a wide signal bandwidth an IF bandwidth of 10 MHz has to be selected, signals are not allowed to be in the range from 6 MHz to 9 MHz above the receive frequency because they will be convoluted back into the useful band of 10 MHz.

Demodulation Bandwidth

Digital filters determine the demodulation bandwidth. This is not the 3 dB bandwidth but the useful bandwidth which is distortion-free with regard to phase and amplitude.

Therefore the following formulas apply:

- AM: demodulation bandwidth ≥ 2 x modulation frequency
- FM: demodulation bandwidth ≥ 2 x (frequency deviation + modulation frequency)
- PM: demodulation bandwidth ≥ 2 * modulation frequency * (1 + phase deviation)

Note: *If the center frequency of the analyzer is not set exactly to the signal frequency, the demodulation bandwidth must be selected larger by the carrier offset, in addition to the requirement described above. This also applies if FM or PM AC coupling has been selected.*

In general, the demodulation bandwidth should be as narrow as possible to improve the S/N ratio. The residual FM caused by noise floor and phase noise increases dramatically with the bandwidth, especially with FM (Fig 1-3 Residual FM as a function of demodulation bandwidth.

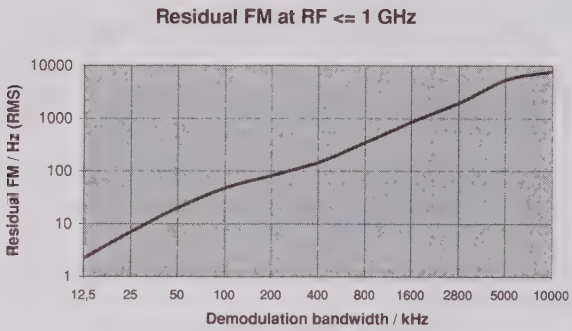

Fig 1-3 Residual FM as a function of demodulation bandwidth

AF Trigger

The FM demodulator option allows triggering to the demodulated signal. The display is stable if a minimum of five modulation periods are within the recording time.

In the AM and FM display, triggering is always DC-coupled. In the PM display, triggering is either AC- or DC-coupled, depending on the type of coupling set. Therefore triggering is possible directly to the point where a specific carrier level, phase or frequency is exceeded or not attained. This is particularly helpful when measuring transients if no external trigger signal is available.

Stability of Measurement Results

Despite amplitude and frequency modulation, the display of carrier power and carrier frequency offset is stable.

This is achieved by a digital filter which sufficiently suppresses the modulation, provided, however, that the measurement time is ≥ 3 x 1 / modulation frequency, i.e. that at least three periods of the AF signal are recorded.

The mean carrier power for calculating the **AM** is also calculated with a digital filter that returns stable results after a measurement time of ≥ 3 * 1 / modulation frequency, i.e. at least three cycles of the AF signal must be recorded before a stable AM can be shown.

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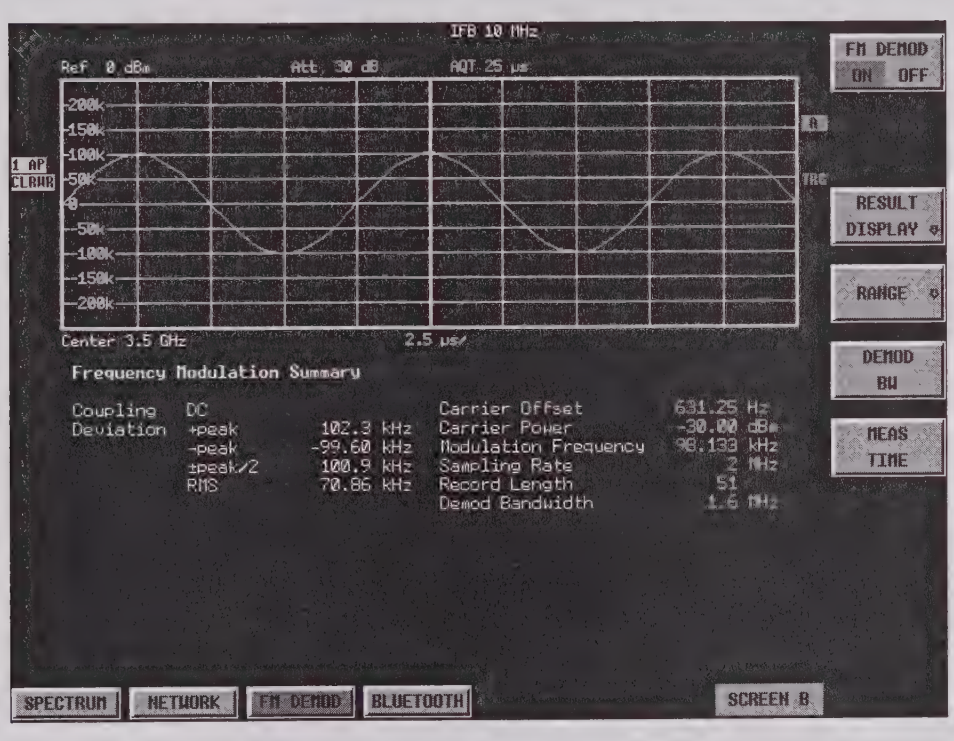
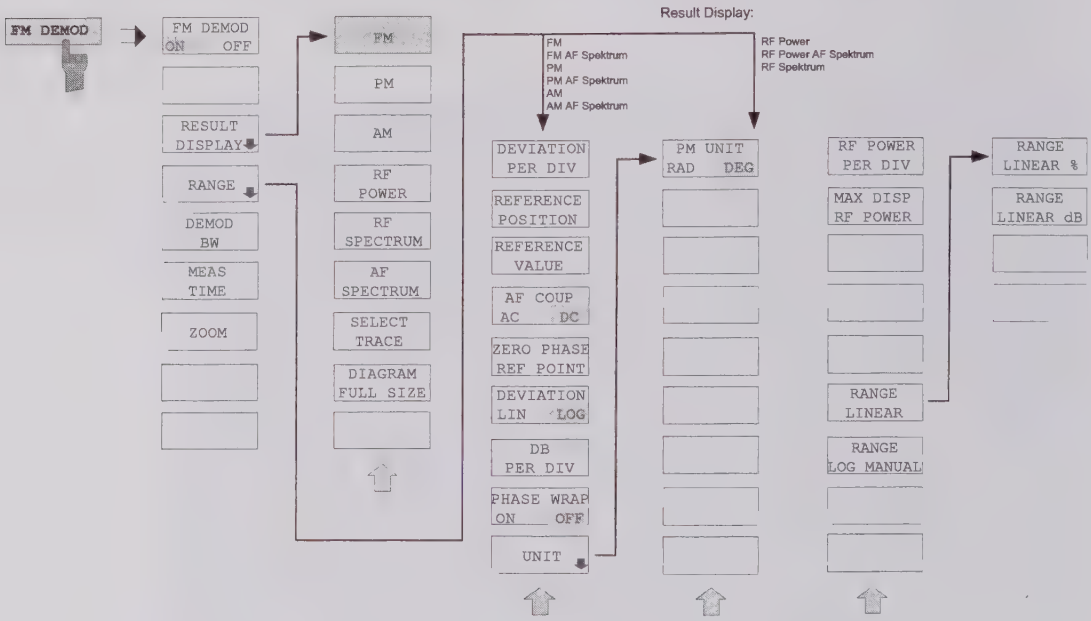
2 Settings of the FM Demodulator

The *FM DEMOD* hotkey opens the menu for setting the FM demodulator functions. Simultaneously, the FM demodulator is activated.



FM Demodulator Main Menu



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Note: *The softkeys visible in the RANGE submenu depend on the selected measurement function (FM / PM / RF SPECTRUM / AF SPECTRUM).*

The *FM DEMOD ON / OFF* softkey switches the FM demodulator on or off. The FM demodulator default setting is *OFF*; however, when the *FM DEMOD* mode is selected, the demodulator is switched on automatically.

Notes:

- *The resolution bandwidth, video bandwidth and sweep time active before the demodulator is switched on are restored when the demodulator is switched off.*
- *Similarly, the trace operating mode and detector are restored (the FM demodulator has separate trace settings).*

IEC/IEEE-bus command

```
INST:SEL ADEM
INST:NSEL 3
```

The *RESULT DISPLAY* softkey opens the submenu for selecting the measurement function required (see chapter "Selection of Display Mode - *RESULT DISPLAY Menu*").

The *RANGE* softkey opens the submenu for setting the display range of the measurement function selected (see chapter "Scaling of Measurement Results - *RANGE Menu*").

The demodulation bandwidth of the FM demodulator is selected using the *DEMOD BW* softkey. The demodulation bandwidth determines the sampling rate for recording the signal to be analyzed.
The following table shows the relation between demodulation bandwidth and sampling rate:

Demodulation bandwidth	Sampling rate	Comment
120 MHz	256 MHz	with FSQ-B72 only
50/85 MHz (1)	128 MHz	with FSQ-B72 only
30 MHz	64 MHz	with FSQ only
18 MHz	32 MHz	with FSQ only
10 MHz	32 MHz	
8 MHz	16 MHz	
5 MHz	8 MHz	
3 MHz	4 MHz	
1.6 MHz	2 MHz	
800 kHz	1 MHz	
400 kHz	500 kHz	
200 kHz	250 kHz	
100 kHz	125 kHz	
50 kHz	62.5 kHz	
25 kHz	31.25 kHz	
12.5 kHz	15.625 kHz	
6.4 kHz	7.8125 kHz	
3.2 kHz	3.90625 kHz	
1.6 kHz	1.953125 kHz	
800 Hz	976.5625 Hz	
400 Hz	488.28125 Hz	
200 Hz	244.140625 Hz	
100 Hz	122.0703125 Hz	

(1) The demodulation bandwidth at a sampling rate of 128 MHz depends on the center frequency that has been set. At a center frequency of ≤3.6 GHz, the demodulation bandwidth is 50 MHz; at higher center frequencies, it is 85 MHz.

IEC/IEEE-bus command `SENS:BAND:DEM 10MHz`

The *MEAS TIME* softkey opens an editor for entering the measurement time of the FM demodulator. The permissible value range depends on the demodulation bandwidth selected.

Demodulation bandwidth	Min. measurement time	Max. measurement time with AF trigger	Max. measurement time with other trigger
120 MHz	3.90625 ns	425 µs	510 µs
50 / 85 MHz	7.8125 ns	850 µs	1.0 ms
30 MHz	15.625 ns	1.7 ms	2.0 ms
18 MHz	31.25 ns	3.4 ms	4.1 ms
10 MHz	31.25 ns	3.4 ms	4.1 ms
8 MHz	62.5 ns	6.8 ms	8.2 ms
5 MHz	125 ns	13.6 ms	16.3 ms
3 MHz	250 ns	27.2 ms	32.6 ms
1.6 MHz	500 ns	54.4 ms	65.3 ms
800 kHz	1 µs	109 ms	131 ms
400 kHz	2 µs	218 ms	261 ms
200 kHz	4 µs	435 ms	522 ms
100 kHz	8 µs	870 ms	1.04 s
50 kHz	16 µs	1.74 s	2.09 s
25 kHz	32 µs	3.48 s	4.18 s
12.5 kHz	64 µs	6.96 s	8.36 s
6.4 kHz	128 µs	13.9 s	16.7 s
3.2 kHz	256 µs	27.8 s	33.4 s
1.6 kHz	512 µs	55.7 s	66.8 s
800 Hz	1.024 ms	111 s	133 s
400 Hz	2.048 ms	222 s	267 s
200 Hz	4.096 ms	445 s	534 s
100 Hz	8.192 ms	891 s	1069 s

IEC/IEEE-bus command

```
SENS:ADEM:MTIM 62.5US
SENS:SWE:TIME 62.5US
```

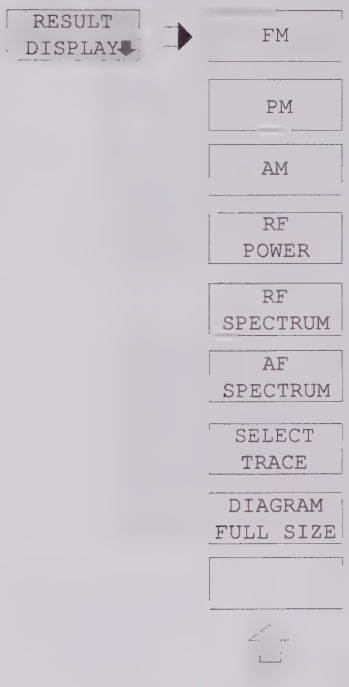
In many cases, the number of recorded test points exceeds by far the number of available pixels. Therefore several test points are combined to one pixel if the *ZOOM* function is inactive.
If the *ZOOM* function is activated, a 1-to-1 allocation is selected, i.e. each pixel corresponds to a recorded test point. The start of the zoom window can be determined in the associated field by entering the time.
The zoom function is not available if the number of test points falls below the number of pixels in the diagram (FSP:501, FSU/FSQ: 625).

IEC/IEEE-bus command

```
SENS:ADEM:ZOOM ON
SENS:ADEM:ZOOM:STARt 30US
```

Selection of Display Mode – *RESULT DISPLAY* Menu

In order to display the measurement results the screen is divided in two halves:
In the upper half, the measurement results are displayed as a trace, in the lower half the results of additional evaluation functions are shown. The *RESULT DISPLAY* softkey allows the user to select the measurement results to be displayed.

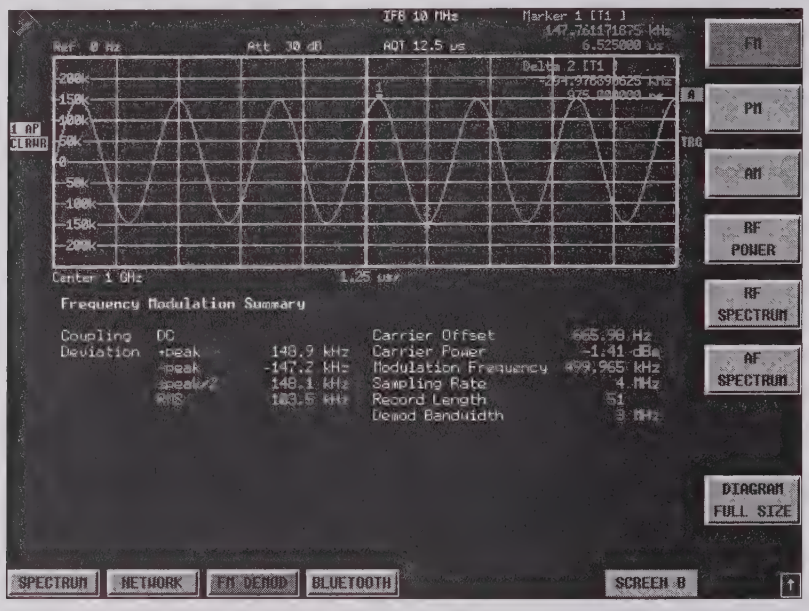


The *RESULT DISPLAY* softkey opens a submenu for selecting the measurement result to be displayed.

The demodulated FM, PM or AM signal, the RF signal in the time domain or the RF or AF frequency spectrum determined via FFT can be selected for display.

All displays are determined from the I/Q data set recorded for the measurement. In *SINGLE SWEEP* mode, the single data set recorded can be evaluated in all displays simply by switching the result display.

The *FM* softkey selects the demodulated FM signal for display. Depending on the *AF COUPLING AC/DC* selection in the *RANGE* menu, the average value of the demodulated signal is mapped onto the vertical center of the diagram (*AC* selected) or deviates from the center of the diagram by a signal-dependent frequency offset (*DC* selected).



In *SINGLE SWEEP* mode, the data is determined from the current I/Q data set, i.e. a change to FM does not trigger a new measurement.

IEC/IEEE-bus command `CALC:FEED 'XTIM:FM'`

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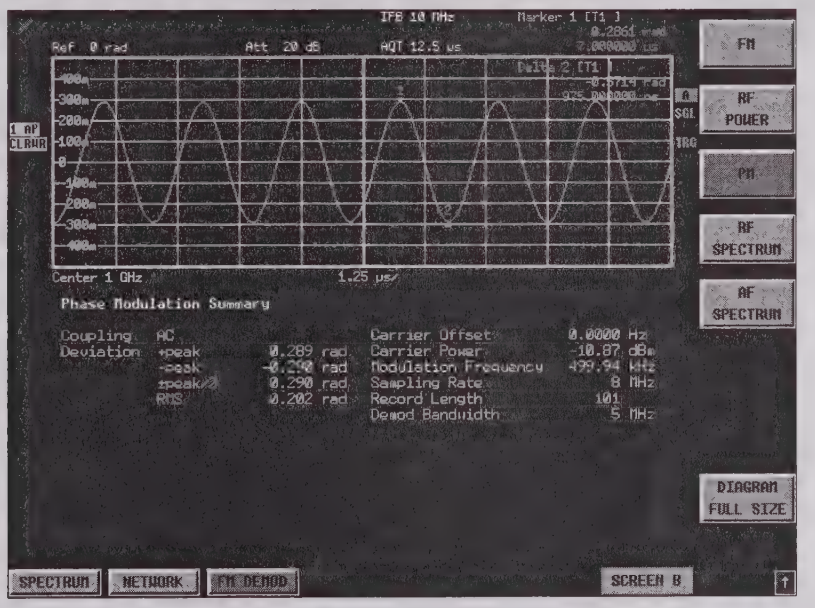
PM

The *PM* softkey selects the display of the demodulated PM signal.

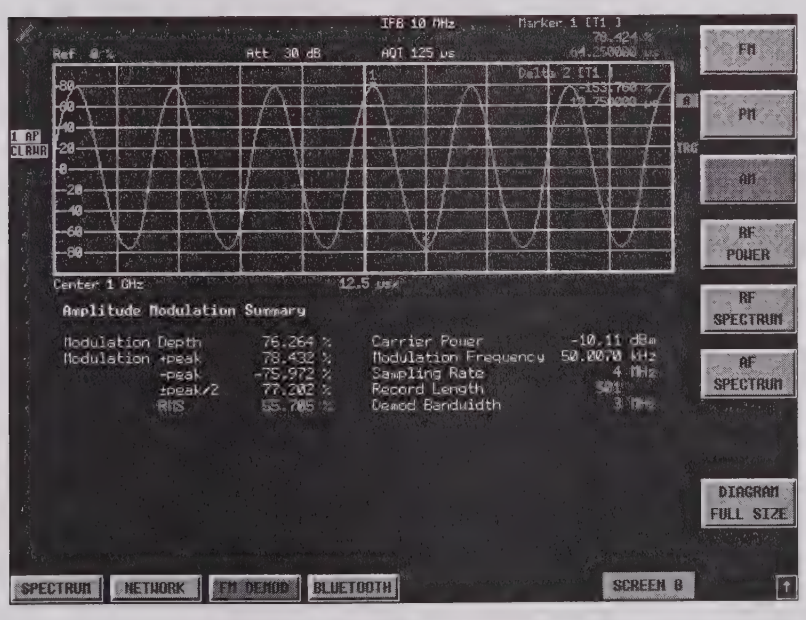


In *SINGLE SWEEP* mode, the data is determined from the current I/Q data set, i.e. a change to *PM* does not trigger a new measurement.

IEC/IEEE-bus command `CALC:FEED 'XTIM:PM'`

AM

The *AM* softkey selects the display of the demodulated AM signal.

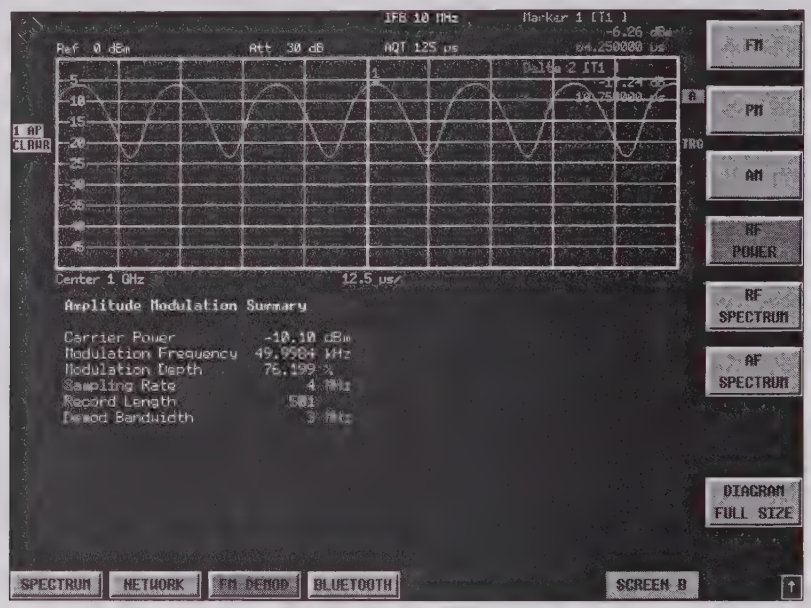


In *SINGLE SWEEP* mode, the data is determined from the current I/Q data set, i.e. a change to *AM* does not trigger a new measurement.

IEC/IEEE-bus command `CALC:FEED 'XTIM:AM:REL'`

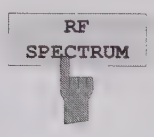
RF POWER

The *RF POWER* softkey selects the display of the RF signal in the time domain. In contrast to normal analyzer operation, the level values are determined from the recorded I/Q data set by means of summation.

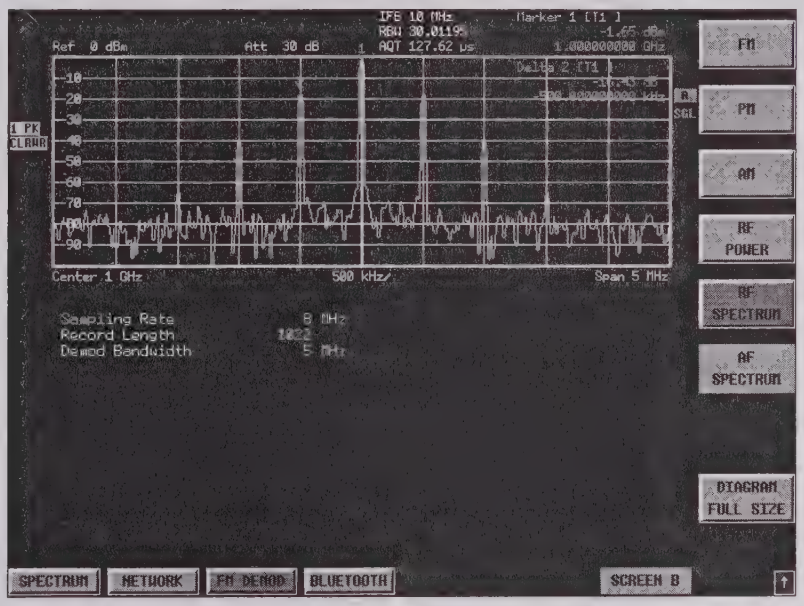


In *SINGLE SWEEP* mode, the data is determined from the current I/Q data set, i.e. a change to *RF POWER* does not trigger a new measurement.

IEC/IEEE-bus command `CALC:FEED 'XTIM:RFP'`



The *RF SPECTRUM* softkey selects the RF signal in the frequency domain for display. In contrast to normal spectrum analyzer operation, the measured values are determined using FFT from the recorded I/Q data set.

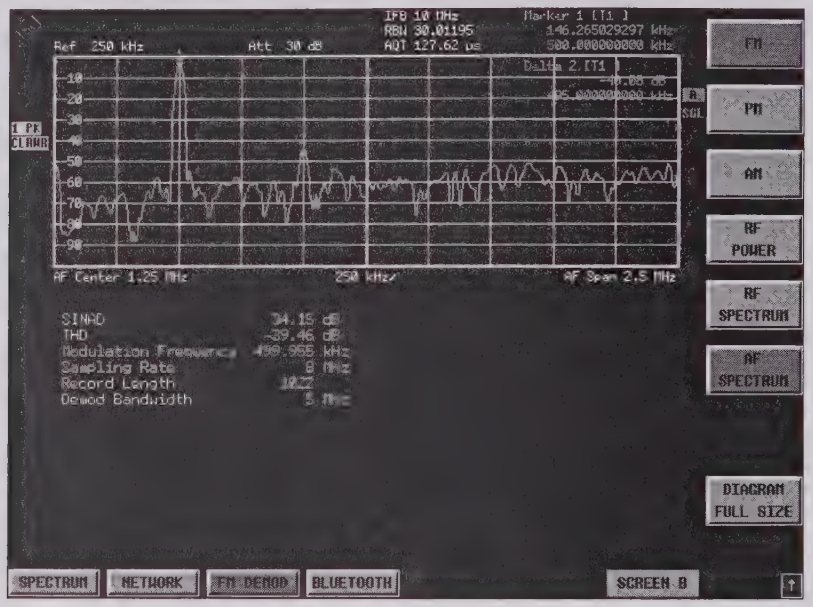


In *SINGLE SWEEP* mode, the data is determined from the current I/Q data set, i.e. a change to *SPECTRUM* does not trigger a new measurement.

IEC/IEEE-bus command `CALC:FEED 'XTIM:SPECTRUM'`

AF SPECTRUM

The *AF SPECTRUM* softkey selects the display of the AF spectrum. The AF spectrum can be calculated from the FM signal, PM signal or the RF signal in the time domain.
The softkey is not available if the RF spectrum display is selected.



In *SINGLE SWEEP* mode, the data is determined from the current I/Q data set, i.e. a change to *AF SPECTRUM* does not trigger a new measurement.

IEC/IEEE-bus command
```
CALC:FEED 'XTIM:FM:AFSP'
CALC:FEED 'XTIM:PM:AFSP'
CALC:FEED 'XTIM:AM:AFSP'
CALC:FEED 'XTIM:RFP:AFSP'
```

SELECT TRACE

The *SELECT TRACE* softkey selects the trace, the data of which is to be displayed in the lower half of the screen.

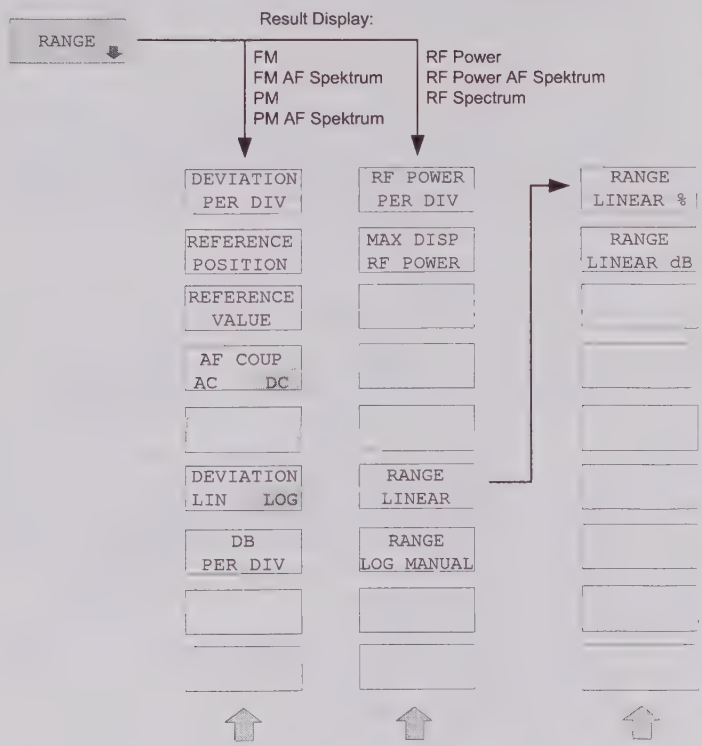
IEC/IEEE-bus command --

FULL SIZE DIAGRAM

The *FULL SIZE DIAGRAM* switches the diagram to full screen size.

IEC/IEEE-bus command: `DISP:SIZE LARG`

Scaling of Measurement Results – *RANGE* Menu



The *RANGE* softkey opens a submenu for determining the diagram scaling for the selected measurement. The softkeys visible depend on the selected measurement function (FM / RF POWER /PM / RF SPECTRUM):

Scaling Functions for *FM, PM* and *AM* Result Display

DEVIATION PER DIV

The *DEVIATION PER DIV* softkey allows the phase or frequency deviation to be displayed in the range 1 Hz/div to 1 MHz/div with the FM display and in the range 0.0001 rad/div to 1000 rad/div with the PM display.
To prevent corruption of the measurement results, the IF bandwidth of the analyzer must be larger than the maximum frequency deviation plus modulation frequency (*IF BANDWIDTH* softkey in the *FM DEMOD* menu).
The softkey is not available in the AF spectrum display of the FM or PM signal, as scaling in this case is performed via the *DB PER DIV* and *REFERENCE VALUE* softkeys.

IEC/IEEE-bus command `DISP:WIND:TRAC:Y:PDIV 50kHz`

REFERENCE POSITON

The *REFERENCE POSITION* softkey determines the position of the reference line for the phase or frequency deviation on the y axis of the diagram. In the default setting of the analyzer, this line corresponds to a frequency deviation of 0 Hz for the display of the FM signal or to a phase deviation of 0 rad for the display of the PM signal.
The position is entered as a percentage of the diagram height with 100 % corresponding to the upper diagram border. The default setting is 50 % (diagram center) for the display of the PM or FM signal and 100% (upper diagram border) for the AF spectrum display of the PM or FM signal.

IEC/IEEE-bus command `DISP:WIND:TRAC:Y:RPOS 50PCT`

The *REFERENCE VALUE* softkey determines the frequency or phase deviation at the reference line of the y axis. The reference value is set separately for each display of the PM and FM signal and the AF spectrum of the PM and FM signal.

FM signal display:

The reference value makes it possible to take individual frequency offsets into account in the trace display (in contrast, the *AF COUP AC/DC* softkey permits automatic correction by the average frequency offset of the signal).
Values between 0 and ± 10 MHz can be selected. The softkey is not available if the *AF COUP AC* function has been activated.

AF spectrum display of the FM signal:

In the default setting, the reference value defines the FM deviation at the upper diagram border.
Values between 0 and 10 MHz can be selected.

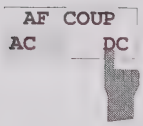
PM signal display:

The reference value makes it possible to take individual phase offsets into account in the trace display (in contrast, the *AF COUP AC/DC* softkey permits automatic correction by the average phase offset of the signal).
Values between 0 and ± 10000 rad can be selected. The softkey is not available if the *AF COUP AC* function has been activated.

AF spectrum display of the PM signal:

In the default setting, the reference value defines the PM deviation at the upper diagram border.
Values between 0 and 10000 rad can be selected.

IEC/IEEE-bus command `DISP:WIND:TRAC:Y:RVAL 0HZ`



The *AF COUP AC/DC* softkey controls the automatic correction of the frequency offset and phase offset of the input signal:

FM signal display:

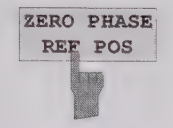
- If DC is selected, the absolute frequency is displayed, i.e. an input signal with an offset relative to the center frequency is not displayed symmetrically with respect to the zero line.
- If AC is selected, the frequency offset is automatically corrected, i.e. the trace is always symmetric with respect to the zero line.

PM signal display:

- If DC is selected, the phase runs according to the existing frequency offset. In addition, the DC signal contains a phase offset of ±π.
- If AC is selected, the frequency offset and phase offset are automatically corrected, i.e. the trace is always symmetric with respect to the zero line.

The softkey is not available with the AF spectrum display of the FM or PM signal.

IEC/IEEE-bus command `SENS:ADEM:AF:COUP DC`



The *ZERO PHASE REF POS* softkey defines the position at which the phase of the PM-demodulated signal is set to 0 rad. The entry is made with respect to time. In the default setting, the first measured value is set to 0 rad.
This softkey is available only in the PM display with DC coupling.

IEC/IEEE-bus command `SENS:ADEM:PM:RPO:X 10us`

The *DEVIATION LIN/LOG* softkey switches between logarithmic and linear display of the frequency deviation or phase deviation or modulation depth (AM). The softkey is only available in the AF spectrum deviation of the FM or PM or AM signal.

IEC/IEEE-bus command `DISP:WIND:TRAC:Y:SPAC LOG`

The *DB PER DIV* softkey makes it possible to select the FM or PM deviation or modulation depth to be displayed in the range 0.1 dB/div to 20 dB/div.
The softkey is not available if linear display is set.

IEC/IEEE-bus command `DISP:WIND:TRAC:Y:PDIV 5DB`

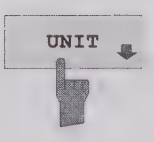
The *PHASE WRAP ON/OFF* softkey activates/deactivates phase wrap.

ON The phase will be displayed in the range ±180° (±π). For example, if the phase exceeds +180°, 360° is subtracted from the phase value, with the display thus showing >-180°.

OFF The phase will not be wrapped.

This softkey in available in the PM signal displays.

IEC/IEEE-bus command `CALC:FORM PHAS`

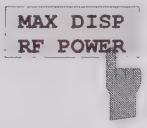


The *UNIT* softkey opens the submenu for selecting units.

The *PM UNIT RAD/DEG* softkey is used to select the unit for displaying PM signals.

IEC/IEEE-bus command `UNIT:ANGL RAD`

Scaling Functions for Result Displays with Level Display



The *MAX DISP RF POWER* determines the maximum RF power to be displayed.
The selected value affects only the display. The reference level determines the dynamic range limit of the analyzer's A/D converter. If the input signal exceeds the selected reference level, the measurement results are impaired by A/D converter overloading. If a value higher than the reference level is selected for MAX DISP RF POWER, the dynamic range limit (= reference level) is highlighted by a red line on the screen:

——— POS x dBm ———

IEC/IEEE-bus command `DISP:WIND:TRAC:Y:RVAL 10 DBM`

The *RF POWER LOG/LIN* softkey allows the user to select logarithmic or linear level display.

IEC/IEEE-bus command `DISP:WIND:TRAC:Y:SPAC LOG`

The *RF POWER PER DIV* softkey determines the RELATIVE power between two divisions on the y axis of the diagram.

IEC/IEEE-bus command `DISP:WIND:TRAC:Y:PDIV 10 DB`

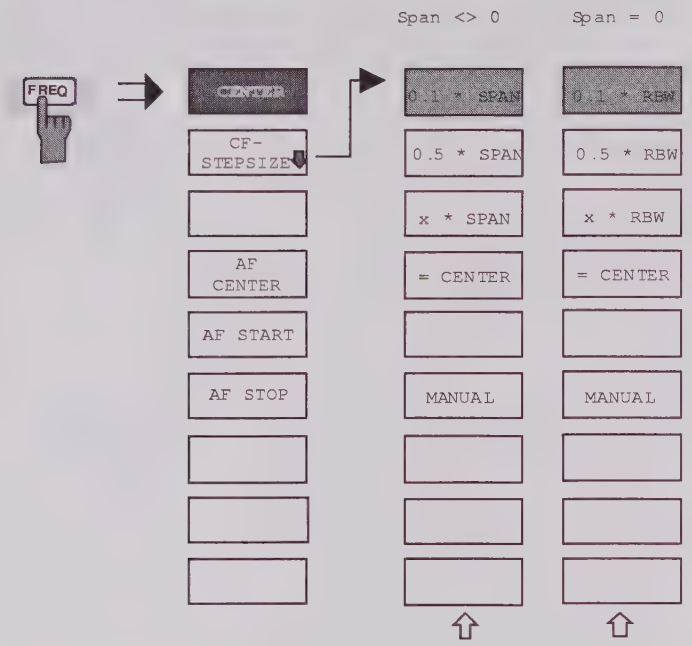
The *RANGE LINEAR* softkey is identical to the softkey of the base unit.

The *RANGE LINEAR %* softkey is identical to the softkey of the base unit.

The *RANGE LINEAR dB* softkey is identical to the softkey of the base unit.

The *RANGE LOG MANUAL* softkey is identical to the softkey of the base unit.

FREQ Key



The *FREQ* menu functions are identical to those of the base unit.

If the AF spectrum display is active, the *AF CENTER*, *AF START* and *AF STOP* softkeys, with which the displayed frequency range is defined within the demodulation bandwidth, are also available.

The *AF CENTER* softkey allows the user to select the center frequency within the AF spectrum.

IEC/IEEE-bus command `SENS:ADEM:AF:CENT 1MHZ`

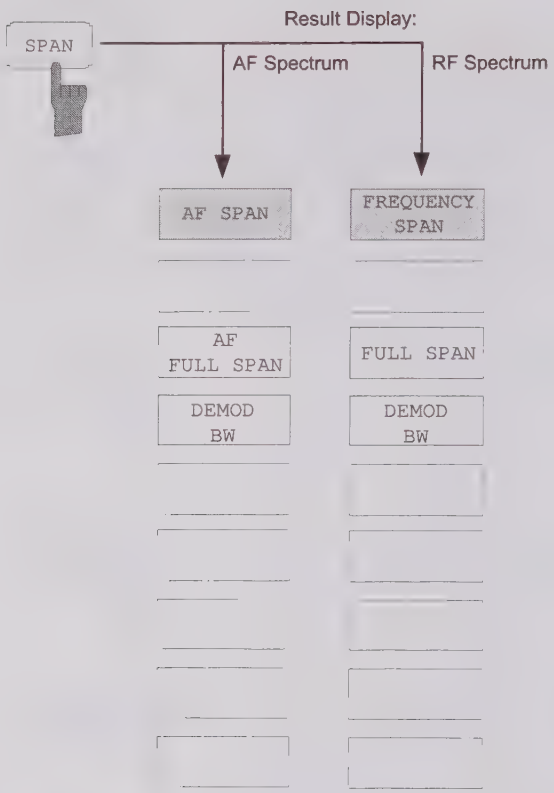
The *AF START* softkey allows the user to select the start frequency within the AF spectrum.

IEC/IEEE-bus command `SENS:ADEM:AF:STAR 0HZ`

The *AF STOP* softkey allows the user to select the stop frequency within the AF spectrum.
The maximum AF stop frequency corresponds to half the demodulation bandwidth.

IEC/IEEE-bus command `SENS:ADEM:AF:STOP 2MHZ`

SPAN Key



The *SPAN* menu allows the user to select the frequency range to be displayed if the spectrum displays of the FM demodulator are active.

The *AF SPAN* softkey allows the user to select the frequency range if the AF spectrum displays are active.
Values between the sampling rate/200 and the demodulation bandwidth/2 can be selected.

IEC/IEEE-bus command `ADEM:AF:SPAN 2.5 MHz`

The *FREQUENCY SPAN* softkey allows the user to select the frequency range if the *RF SPECTRUM* display is active.
Values between the sampling rate/200 and the demodulation bandwidth/2 can be selected.

IEC/IEEE-bus command `ADEM:SPEC:SPAN:ZOOM 5 MHz`

The *AF FULL SPAN* softkey sets the maximum frequency range if the AF spectrum displays are active.
The maximum frequency range corresponds to half the demodulation bandwidth.

IEC/IEEE-bus command `ADEM:AF:SPAN:FULL`

The *FULL SPAN* softkey sets the maximum frequency range if the RF spectrum display is active.
The maximum frequency range corresponds to the demodulation bandwidth.

IEC/IEEE-bus command `ADEM:SPEC:SPAN:ZOOM MAX`

The demodulation bandwidth of the FM demodulator is selected with the *DEMOD BW* softkey.

Note:
The function is identical to the function of the DEMOD BW softkey in the FM DEMOD main menu.

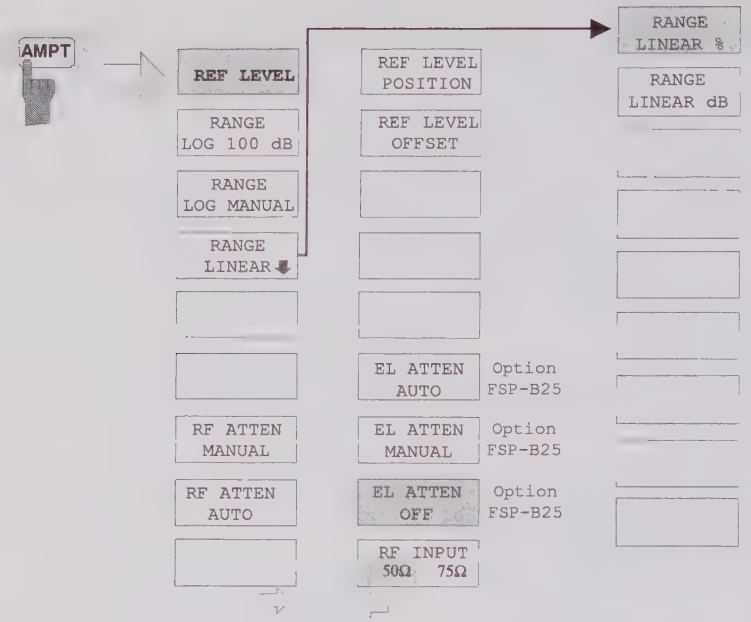
IEC/IEEE-bus command `SENS:BAND:DEM 10MHz`

The *MEAS TIME* softkey opens the input field for the measurement time of the FM demodulator.

Note:
The function is identical to the function of the MEAS TIME softkey in the FM DEMOD main menu.

IEC/IEEE-bus command
```
SENS:ADEM:MTIM 62.5US
SENS:SWE:TIME 62.5US
```

AMPT Key



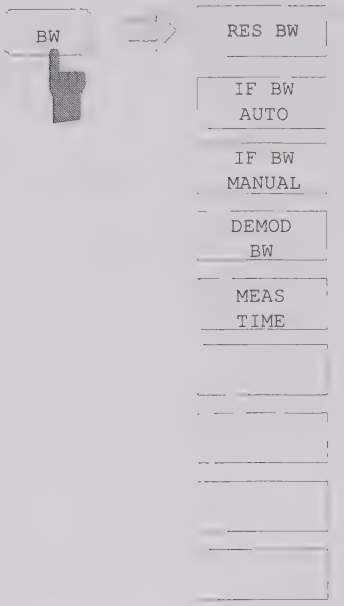
The *AMPT* menu functions are identical to those of the base unit.

Die following functions are only available with level displays:

RANGE LOG 100 dB
RANGE LOG MANUAL
RANGE LINEAR

Note:
The REF LEVEL value defines the clipping level of the A/D converter and must therefore be set greater than or equal to the maximum power of the signal to be analyzed.

BW Key

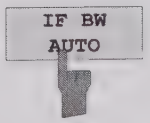


The *BW* menu comprises all functions relating to the band limiting of the analyzed signal.

If the Spectrum result display is active, the *RES BW* softkey selects the resolution bandwidth for the signal displayed. Note that these resolution bandwidths are obtained by means of FFT filters from 1 Hz to 10 MHz.

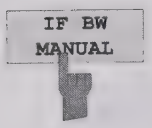
Notes: *The softkey is available only if the RF SPECTRUM or AF SPECTRUM result display is active.*
The IF bandwidth is limited by analog LC filters using the IF BW MANUAL and IF BW AUTO softkeys.

IEC/IEEE-bus command `ADEM:SPEC:BAND:RES 10 kHz`



The *IF BW AUTO* softkey couples the IF bandwidth of the analyzer (i.e. the bandwidth of the analog LC filters) to the selected demodulation bandwidth.

IEC/IEEE-bus command `BAND:RES:AUTO ON`



The *IF BW MANUAL* softkey allows the IF bandwidth of the analyzer to be entered (i.e. the bandwidth of the analog filters). Bandwidths from 300 kHz to 10 MHz can be selected.

IEC/IEEE-bus command `BAND:RES 1 MHz`

Notes: *Manual setting of the IF bandwidth is usually not required. If an IF bandwidth is set that is narrower than the value defined by AUTO coupling,*

a) the RF frequency response is identical to that of the IF filter if the spectrum display is active,

b) an AF frequency response corresponding to a lowpass filter equivalent to the IF filter occurs in the case of FM demodulation.

The demodulation bandwidth of the FM demodulator is selected via the *DEMOD BW* softkey.

Note: *The function is identical to that of the DEMOD BW softkey in the FM DEMOD main menu.*

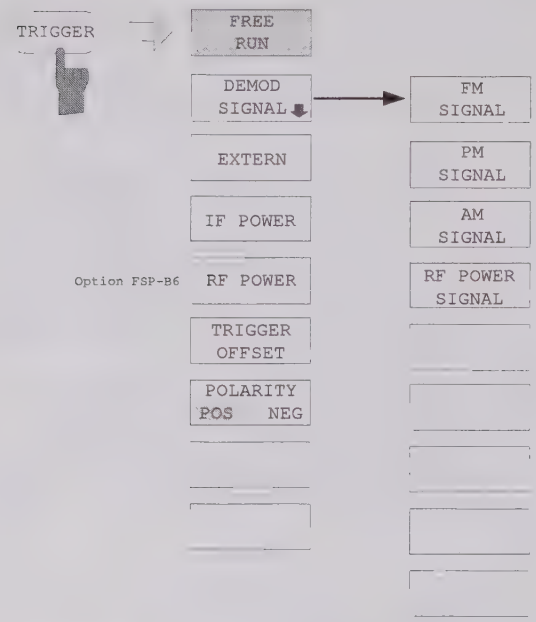
IEC/IEEE-bus command `SENS:BAND:DEM 10MHz`

The *MEAS TIME* softkey opens the editor for entering the data-recording time of the FM demodulator.

Note: *The function is identical to that of the MEAS TIME softkey in the FM DEMOD main menu.*

IEC/IEEE-bus command
```
SENS:ADEM:MTIM 62.5US
SENS:SWE:TIME 62.5US
```

TRIG Key

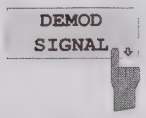


The *TRIG* key opens a menu for setting the different trigger sources and for selecting the trigger polarity. The active trigger mode is indicated by highlighting the associated softkeys.

To indicate that a trigger mode other than FREE RUN has been set, the **TRG** enhancement label is displayed on the screen. If two measurement windows are displayed, TRG is indicated next to the window in question.

The *FREE RUN* softkey activates the free-running sweep, i.e. the measurement start is not triggered explicitly. When a measurement is completed, the next one starts immediately. *FREE RUN* is the default setting.

IEC/IEEE-bus command: `TRIG:SOUR IMM`

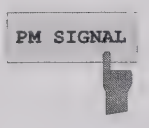


The *DEMOD SIGNAL* softkey opens the menu for selecting the various trigger sources.

With a modulated signal, the trigger source that is selected with the FM SIGNAL softkey is the point at which a specific absolute phase is reached by the input signal. The associated trigger threshold can be entered simultaneously.
Measurement is triggered if the selected threshold is exceeded. A periodic signal modulated onto the carrier frequency can be displayed in this way.

Notes: *For triggering with the FM SIGNAL trigger source to be successful, the measurement time must cover at least five periods of the audio signal. The triggering responds to the absolute frequency, i.e. it is always DC-coupled.*

IEC/IEEE-bus command:
```
TRIG:SOUR FM
TRIG:LEV:FM 10 kHz
```



With a modulated signal, the trigger source that is selected with the *PM SIGNAL* softkey is the point at which a specific absolute frequency is reached. The associated trigger threshold can be entered simultaneously.
Measurement is triggered if the selected threshold is exceeded. A periodic signal modulated onto the carrier frequency can be displayed in this way.

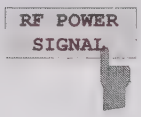
Note: *For triggering with the PM SIGNAL trigger source to be successful, the measurement time must cover at least five periods of the audio signal. Triggering is either AC- or DC-coupled, depending on the AF COUPLING AC/DC setting in the RANGE menu.*

IEC/IEEE-bus command:
```
TRIG:SOUR PM
TRIG:LEV:PM 0.2 rad
```

With a modulated signal, the trigger source that is selected with the *AM SIGNAL* softkey is the point at which a specific modulation depth is reached. The associated trigger threshold can be entered simultaneously.
Measurement is triggered if the selected threshold is exceeded. A periodic signal modulated onto the carrier frequency can be displayed in this way.

Note: *For triggering with the AM SIGNAL trigger source to be successful, the measurement time must cover at least five periods of the audio signal.*

IEC/IEEE-bus command:
```
TRIG:SOUR AMR
TRIG:LEV:AM:REL 0.2 rad
```



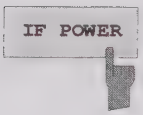
With a modulated signal (AF signal), the trigger source that is selected with the *RF POWER SIGNAL* softkey is the point at which a specific signal level is reached. The associated trigger threshold can be entered simultaneously.
Measurement is triggered if the selected threshold is exceeded. A periodic signal modulated onto the carrier frequency can be displayed in this way.

Note: *The RF POWER SIGNAL trigger differs from the RF POWER trigger in that the AF signal is taken into account rather than the RF signal. For triggering with the AM trigger source to be successful, the measurement time must cover at least five periods of the audio signal.*

IEC/IEEE-bus command:
```
TRIG:SOUR AM
TRIG:LEV:AM -30 dBm
```

The EXTERN softkey activates triggering by a TTL signal at the *EXT TRIGGER/GATE* input connector on the rear panel.

IEC/IEEE-bus command:
```
TRIG:SOUR  EXT
SWE:EGAT:SOUR  EXT
```



The *IF POWER* softkey activates triggering of measurement by means of signals outside the measurement channel.
To this end, the FSP uses a level detector on the second intermediate frequency. The threshold of the level detector can be selected between -30 dBm and -10 dBm at the input mixer.
This means that the input signal range within which the trigger responds can be calculated as follows:

$$Mixerlevel_{min} + RFAtt - \Pr eampGain \leq Input\ Signal \leq Mixerlevel_{max} + RFAtt - \Pr eampGain$$

The bandwidth on the intermediate frequency is 10 MHz. The measurement is triggered if the trigger threshold is exceeded by a signal in a range of 5 MHz around the center frequency.
This allows spurious signals to be measured, such as pulsed carriers, even if the carrier itself is not within the display frequency range.

IEC/IEEE-bus command:
```
TRIG:SOUR  IFP
SWE:EGAT:SOUR  IFP
```

The *RF POWER* softkey activates triggering of measurement by means of signals outside the measurement channel.

To this end, the analyzer uses a level detector on the first intermediate frequency. The threshold of the level detector can be selected between -50 dBm and -10 dBm at the input mixer. This means that the input signal range within which the trigger responds can be calculated as follows:

$$Mixerlevel_{min} + RFAtt - \Pr eampGain \leq Input\ Signal \leq Mixerlevel_{max} + RFAtt - \Pr eampGain$$

The bandwidth on the intermediate frequency is 80 MHz. The measurement is triggered if the trigger threshold is exceeded by the set frequency in a 40 MHz range. This allows spurious to be measured, such as pulsed carriers, even if the carrier itself is not within the display frequency range.

Note: *The function is only available with option TV and RF Trigger FSP-B6.*

IEC/IEEE-bus command: `TRIG:SOUR RFP`
`SWE:EGAT:SOUR RFP`

The *TRIGGER OFFSET* softkey allows the user to enter a time offset between the trigger signal and the beginning of the measurement.
Triggering is delayed (entry value >0) or advanced (entry value <0) by the time entered.
The permissible setting range depends on the demodulation bandwidth and is given in the following table:

Demodulation bandwidth	Min. trigger offset	Max. trigger offset
120 MHz	-126 ns	31.7ms
50 / 85 MHz	-253 ns	63.5 ms
30 MHz	-507 ns	126.9 ms
18 MHz	-1 ms	253.9 ms
10 MHz	-2 ms	507.9 ms
8 MHz	-4.1 ms	1015.8 ms
5 MHz	-8.1 ms	2031.6 ms
3 MHz	-16.3 ms	4064.1 ms
1.6 MHz	-32.5 ms	8126.2 ms
800 kHz	-65 ms	16.2524 s
400 kHz	-130 ms	32.5048 s
200 kHz	-260.1 ms	65.0097 s
100 kHz	-520.2 ms	130.0193 s
50 kHz	-1040.4 ms	260.0386 s
25 kHz	-2080.7 ms	520.0773 s
12.5 kHz	-4151.5 ms	1040.1546 s
6.4 kHz	-8.322 s	2080.3 s
3.2 kHz	-16.64 s	4160.6 s
1:6 kHz	-33.29 s	8321.2 s
800 Hz	-66.58 s	16642 s
400 Hz	-133.1s	33284 s
200 Hz	-266.3 s	66569 s
100 Hz	-532.6 s	133139 s

IEC/IEEE-bus command `TRIG:HOLD 10US`

The *POLARITY POS/NEG* softkey determines the trigger slope polarity.

The measurement sequence starts upon a positive or negative slope of the trigger signal. The valid setting is highlighted.

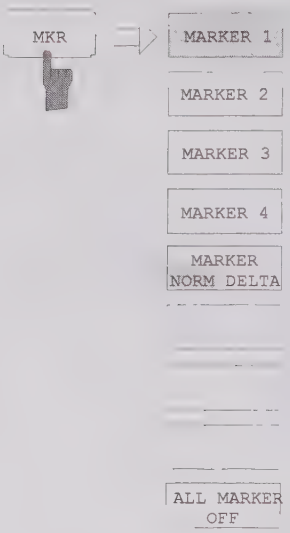
The setting is valid for all trigger modes except *FREE RUN*.

The default setting is *POLARITY POS*.

Note: *The function is available only for detector boards with model index ≥ 3. Previous boards ignore the setting.*

IEC/IEEE-bus command: `TRIG:SLOP POS`

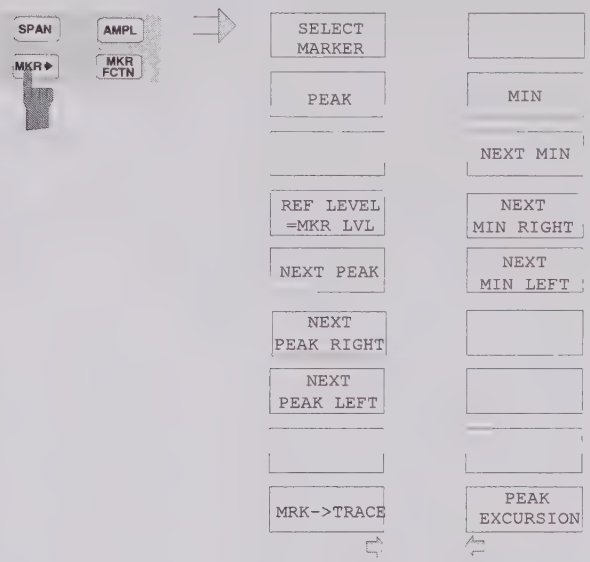
MKR Key



The *MKR* menu functions are identical to those of the base unit.

Only the measurement result display is coupled to the active result display and is in Hz if FM and FM AF spectrum are selected, in rad if PM and PM AF spectrum are selected, or in dBm or dB if RF POWER, RF POWER AF spectrum and RF SPECTRUM are selected.

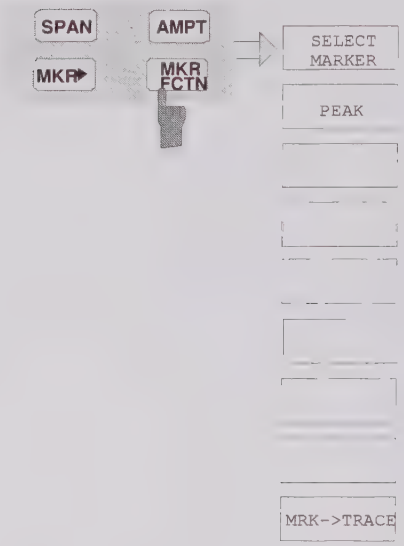
MKR ⇒ Key



The *MKR ⇒* menu functions are identical to those of the base unit.
The function *REF LEVEL = MKR LVL*

is not available if the FM result display is active.

MKR FCTN Key



The available *MKR FCTN* menu functions are identical to those of the base unit.

MEAS Key

The *MEAS* menu functions are not available in the FM DEMOD mode.

Other Keys

The functions of the other keys are identical to those of the base unit. Please refer to the relevant chapters in the operating manual of the base unit.

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3 Remote Control - Description of Commands

The information in this chapter supplements and updates chapters 5 and 6 of the FSP manual. This chapter contains the new commands that apply specifically to option FS-K7 as well as the modified commands of the basic instrument provided they are used by FS-K7.

Every attempt was made to ensure the highest possible compatibility of the FS-K7 commands with those of analog demodulation of the FSE family. A few commands were included in the command set for this reason only.

In the description of menu operation in chapter 2, each softkey is indicated with the associated IEC/IEEE bus commands.

Note: *The measurements of the FM Demodulator mode are always carried out in screen A. Therefore, the commands where the numeric suffix selects the screen must either start with numeric suffix 1 (i.e.* `CALCulate1)` *or without a numeric suffix (i.e.* `CALCulate)`*.*

Common Commands

COMMAND	PARAMETERS	UNIT	COMMENT
*OPT?			Option Identification Query; query only

*OPT?

OPTION IDENTIFICATION QUERY queries the options included in the instrument and returns a list of the installed options. The options are separated by commas. In the response string, the identification of option FS-K7 is indicated at position 32:

Example:
0,0,0,

CALCulate:DELTamarker Subsystem

The CALCulate:DELTamarker subsystem controls the delta marker functions in the instrument.

COMMAND	PARAMETERS	UNIT	COMMENT
CALCulate<1|2> :DELTamarker<1...4> :Y?	--	--	query only

CALCulate<1|2>:DELTamarker<1...4>:Y?

This command queries the measured value of the selected delta marker in the indicated measurement window. The corresponding delta marker will be activated, if necessary. The output is always a relative value referred to marker 1.

To obtain a valid query result, a complete sweep with synchronization to the sweep end must be performed between the activation of the delta marker and the query of the y value. This is only possible in single sweep mode.

Depending on the on the activated measuring functions, the query result is output in the units below:

- Result display FM: Hz
- Result display PM: rad | deg
- Result display AM: %
- Result display RF POWER: dB (logarithmic display)
  % (linear display)
- Result display RF SPECTRUM: dB (logarithmic display)
  % linear display)
- Result display AF SPECTRUM: dB (logarithmic display)
  Hz | % | rad | deg (linear display)

Example:

```
"INIT:CONT OFF"     Switch to single-sweep mode
"CALC:DELT2 ON"     Switch on delta marker 2
"INIT;*WAI"         Start a sweep and wait for its end
"CALC:DELT2:Y?"     Output measured value of delta marker 2.
```

Characteristics: *RST value: -
SCPI: device-specific

CALCulate:FEED Subsystem

The CALCulate:FEED subsystem selects the type of evaluation of the measured data. This corresponds to the selection of the Result Display in manual mode.
If the FM demodulator is active, the selection of the type of evaluation is independent of the measurement window. Therefore, the numeric suffix <1|2> is irrelevant and ignored.

COMMAND	PARAMETERS	UNIT	COMMENT
CALCulate<1|2> :FEED	<string>		no query

CALCulate<1|2>:FEED <string>

This command selects the trace data to be displayed.

Parameters:

<string>::=

'XTIM:AM:RELative[:TDOMain]'	Demodulated AM signal in standardized display.
'XTIM:AM:RELative:AFSPectrum<1...3>'	AF spectrum of the demodulated AM signal in standardized display, results referenced to traces 1 to 3.
'XTIM:AM[:ABSolute][:TDOMain]'	Demodulated AM signal in level display. Same as 'XTIM:RFPower'.
'XTIM:AM[:ABSolute]:AFSPectrum<1...3>'	AF spectrum of the demodulated AM signal in level display, results referenced to traces 1 to 3. Same as 'XTIM:RFPower:AFSPectrum'.
'XTIM:RFPower[:TDOMain]'	Demodulated AM signal in level display.
'XTIM:RFPower:AFSPectrum<1...3>'	AF spectrum of the demodulated AM signal in level display, results referenced to traces 1 to 3.
'XTIM:FM[:TDOMain]'	Demodulated FM signal.
'XTIM:FM:AFSPectrum<1...3>'	AF spectrum of the demodulated FM signal, results referenced to traces 1 to 3.
'XTIM:PM[:TDOMain]'	Demodulated PM signal
'XTIM:PM:AFSPectrum<1...3>'	AF spectrum of the demodulated PM signal
'XTIM:AMSummary<1...3>[:ABSolute]'	AM results in level display, referenced to traces 1 to 3.
'XTIM:AMSummary<1...3>:RELative'	AM results in standardized display, referenced to traces 1 to 3.
'XTIM:FMSummary<1...3>'	FM results, referenced to traces 1 to 3
'XTIM:PMSummary<1...3>'	PM results, referenced to traces 1 to 3.
'XTIM:SPECtrum'	RF spectrum of the signal determined from the measured data via FFT.

Example: `"CALC:FEED 'XTIM:FM'"` Select the display of the FM signal

Characteristics: *RST value: XTIM:FM'
SCPI: conforming

CALCulate:FORMat - Subsystem

The CALCulate:FORMat subsystem defines the conversion of measured data.

COMMAND	PARAMETERS	UNIT	COMMENT
CALCulate<1|2> :FORMat	PHASe | UPHase		

:CALCulate<1|2>:FORMat PHASe | UPHase

This command activates the limitation to ±180°.

Parameter: PHASe: Limitation to ±180°
UPHase: Unwrapped

Example: `":CALC:FORM PHAS"` activated the limitation to ±180°.

Characteristics:: *RST value: UPAS
SCPI: conforming

CALCulate:MARKer Subsystem

The CALCulate:MARKer subsystem controls the marker functions in the instrument.

COMMAND	PARAMETERS	UNIT	COMMENT
CALCulate<1|2>			
:MARKer<1...4>			
:Y?	--	--	query only
:PEXCursion	<numeric_value>	DB | DEG | RAD | HZ PCT	

CALCulate<1|2>:MARKer<1...4>:Y?

This command queries the measured value of the selected marker in the selected measurement window. The corresponding marker is activated before or switched to marker mode, if necessary. To obtain a valid query result, a complete sweep with synchronization to the sweep end must be performed between the activation of the marker and the query of the y value. This is only possible in single sweep mode.

Example:

```
"INIT:CONT OFF"     Switch to single-sweep mode
"CALC:MARK2 ON"     Switch on marker 2
"INIT;*WAI"         Start a sweep and waits for its end
"CALC:MARK2:Y?"     Output the measured value of marker 2.
```

Characteristics: *RST value: -
SCPI: device-specific

CALCulate<1|2>:MARKer<1...4>:PEXCursion <numeric_value>

This command defines the peak excursion, i.e. the spacing below the trace maximum which must be attained before a new maximum is recognized, or the spacing above the trace minimum which must be attained before a new minimum is recognized. The set value is valid for all markers and delta markers.
The unit of the numerical value depends on the active display.

Example:

```
"CALC:MARK:PEXC 10dB"          ' SPECTRUM display
"CALC:MARK:PEXC 100 Hz"        ' FM DEMOD display
```

Characteristics: *RST value: 50 kHz (for FM displays)
0.5 RAD (for PM displays)
5 PCT (for standardized AM displays)
6 dB (for level displays)
SCPI: device-specific

The numeric suffix <1...4> in MARKer is irrelevant.

CALCulate:MARKer:FUNCtion:ADEMod Subsystem

The CALCulate:MARKer:FUNCtion:ADEMod subsystem contains the marker functions for the option FM Demodulator FS-K7.

COMMAND	PARAMETERS	UNIT	COMMENT
CALCulate<1|2>			
:MARKer			
:FUNCtion			
:ADEMod			Option FM Demodulator
:AM			
[:RESult<1...3>?]	PPEak | MPEak | MIDDle | RMS		query only
:FM			
[:RESult<1...3>?]	PPEak | MPEak | MIDDle | RMS		query only
:PM			
[:RESult<1...3>?]	PPEak | MPEak | MIDDle | RMS		query only
:AFRequency			
[:RESult<1...3>?]			query only
:FERRor			
[:RESult<1...3>?]			query only
:SINad			
:RESult<1...3>?			query only
:THD			
:RESult<1...3>?			query only
:CARRier			
[:RESult<1...3>?]			query only

CALCulate<1|2>:MARKer<1...4>:FUNCtion:ADEMod:AM[:RESult<1...3>]? PPEak| MPEak| MIDDle| RMS

This command queries the results of the AM modulation measurement. The numeric suffix (:RESult<1...3>) indicates whether trace 1, 2 or 3 is selected.

PPEak Result of measurement with detector +PK
MPEak Result of measurement with detector -PK
MIDDle Result of averaging ±PK/2
RMS Result of measurement with detector RMS

Example:

```
"ADEM ON"                              'Switch on FM demodulator
"CALC:FEED 'XTIM:AM:REL:TDOM"          'Switch on AM result display
"DISP:TRAC ON"                         'Switch on trace
"CALC:MARK:FUNC:ADEM:AM? PPE"          'Query the peak value
```

Characteristics: *RST value: -
SCPI: device-specific

CALCulate<1|2>:MARKer<1...4>:FUNCtion:ADEMod:FM[:RESult<1...3>]? PPEak|MPEak|MIDDle|RMS

This command queries the results of FM modulation measurement. The numeric suffix indicates whether trace 1, 2 or 3 is selected.

PPEak Result of measurement with detector +PK
MPEak Result of measurement with detector -PK
MIDDle Result of averaging ±PK/2
RMS Result of measurement with detector RMS

Example:

```
"ADEM ON"                              'Switch on FM demodulator
"CALC:FEED 'XTIM:AM:REL:TDOM"          'Switch on AM result display
"DISP:TRAC ON"                         'Switch on trace
"CALC:MARK:FUNC:ADEM:AM? PPE"          'Query the peak value
```

Characteristics: *RST value: -
SCPI: device-specific

CALCulate<1|2>:MARKer<1...4>:FUNCtion:ADEMod:PM[:RESult<1...3>]?PPEak|MPEak|MIDDle|RMS

This command queries the results of the PM modulation measurement of analog demodulation. The numeric suffix (:RESult<1...3>) indicates whether trace 1, 2 or 3 is selected.

PPEak	Result of measurement with detector +PK
MPEak	Result of measurement with detector -PK
MIDDle	Result of averaging ±PK/2
RMS	Result of measurement with detector RMS

Example:
```
"ADEM ON"                          'Switch on FM demodulator
"CALC:FEED 'XTIM:PM:TDOM"          'Switch on PM result display
"DISP:TRAC ON"                     'Switch on trace
"CALC:MARK:FUNC:ADEM:PM? PPE"      'Query the peak value
```

Characteristics: *RST value: -
SCPI: device-specific

CALCulate<1|2>:MARKer<1...4>:FUNCtion:ADEMod:AFRequency[:RESult<1...3>]?

This command queries the audio frequency with analog demodulation. The numeric suffix indicates whether trace 1, 2 or 3 is selected.

Note: *If several demodulation modes are activated simultaneously with command SENS:ADEM:FM:TYPE, SENS:ADEM:PM:TYPE, SENS:ADEM:AM:TYPE, SENS:ADEM:RFP:TYPE, SENS:ADEM:FM:AFSP:TYPE, SENS:ADEM:PM:AFSP:TYPE, SENS:ADEM:AM:AFSP:TYPE or SENS:ADEM:RFP:AFSP, the audio frequency of the display mode selected with CALC:FEED is returned.*

Example:
```
"ADEM ON"                          'Switch on FM demodulator
"CALC:FEED 'XTIM:AM:TDOM"          'Switch on AM result display
```
or
```
"CALC:FEED 'XTIM:FM:TDOM"          'Switch on FM result display
```
or
```
"CALC:FEED 'XTIM:FM:AFSP"          'Switch on AF spectrum result
"DISP:TRAC ON"                     'display of the FM and trace
```
or
```
"CALC:FEED 'XTIM:RFP:AFSP"         'Switch on AF spectrum result display
"DISP:TRAC ON"                     ' of the RF power signal and trace
"CALC:MARK:FUNC:ADEM:AFR? "        'Query audio frequency
```

Characteristics: *RST value: -
SCPI: device-specific

CALCulate<1|2>:MARKer<1...4>:FUNCtion:ADEMod:FERRor[:RESult<1...3>]?

This command queries the frequency error with FM and PM demodulation. With FM demodulation, trace 1 to 3 is selected with the numeric suffix (:RESult<1...3>). With PM demodulation, the frequency error is determined from the current measurement data (CLR/WRITE trace).
The mean offset thus determined differs from that calculated in the `[SENSe:]ADEMod:FM:OFFSet?` query, since, for determining the frequency deviation, the modulation is removed by means of lowpass filtering, producing results that are different from those obtained by averaging with the SENSe:... command.
This command is available only for traces in the FM and PM result displays. If any other result display is selected, this command is disabled.

Example:
```
"ADEM ON"                          'Switch on FM demodulator
"CALC:FEED 'XTIM:FM:TDOM"          'Switch on FM result display
"CALC:MARK:FUNC:ADEM:FERR? "       'Query frequency error of trace 1
```

Characteristics: *RST value: -
SCPI: device-specific

CALCulate<1|2>:MARKer<1...4>:FUNCtion:ADEMod:SINad:RESult<1...3>?

This command queries the result of the SINAD measurement. The numeric suffix (:RESult<1...3>) indicates whether trace 1, 2 or 3 is selected.

Example:

```
"ADEM ON"                          'Switch on FM demodulator
"CALC:FEED 'XTIM:FM:AFSP"          'Switch on AF spectrum of FM
"DISP:TRAC ON"                     'Switch on trace
"CALC:MARK:FUNC:ADEM:SIN:RES?"     'Query SINAD result
```

Characteristics: *RST value: -
SCPI: device-specific

CALCulate<1|2>:MARKer<1...4>:FUNCtion:ADEMod:THD:RESult<1...3>?

This command queries the result of the THD measurement. The numeric suffix (:RESult<1...3>) indicates whether trace 1, 2 or 3 is selected.

Example:

```
"ADEM ON"                          'Switch on FM demodulator
"CALC:FEED 'XTIM:FM:AFSP"          'Switch on AF spectrum of FM
"DISP:TRAC ON"                     'Switch on trace
"CALC:MARK:FUNC:ADEM:THD:RES?"     'Query THD result
```

Characteristics: *RST value: -
SCPI: device-specific

CALCulate<1|2>:MARKer<1...4>:FUNCtion:ADEMod:CARRier[:RESult<1...3>]?

This command queries the carrier power.

With the RF power result display, the carrier power is determined from trace 1 to 3 as specified in the numeric suffix. With all other result displays, the carrier power is determined from the current trace data (CLR/WRITE trace).

Example:

```
"ADEM ON"                          'Switch on FM demodulator
"CALC:FEED 'XTIM:RFP"              'Switch on RF power result display
"CALC:MARK:FUNC:ADEM:CARR?"        'Query carrier power
```

Characteristics: *RST value: -
SCPI: device-specific

CALCulate:UNIT Subsystem

The CALCulate:Unit subsystem defines the units for the parameters that can be set and the measurement results.

COMMAND	PARAMETERS	UNIT	COMMENT
CALCulate<1|2> :UNIT :ANGLe	DEG | RAD		

CALCulate<1|2>: UNIT:ANGLe DEG | RAD

This command selects the unit for angles.

Example: "CALC:UNIT:ANGL DEG"

Characteristics: *RST value: RAD
SCPI: device-specific

DISPlay Subsystem

The DISPLay subsystem controls the selection and presentation of textual and graphic information as well as of trace data on the display.

COMMAND	PARAMETERS	UNIT	COMMENT
DISPlay			
[:WINDow<1|2>]			
:TRACe<1...3>			
:Y			
[:SCALe]			
:RVALue	<numeric_value>	DB | HZ | PCT DEG | RAD	
:RPOSition	<numeric_value>	PCT	
:PDIVision	<numeric_value>	DB | HZ PCT DEG|RAD	
:SPACing	LINear|LOGarithmic|LDB		

DISPlay[:WINDow<1|2>]:TRACe<1...3>:Y[:SCALe]:RVALue <numeric_value>

This command defines the reference value assigned to the reference position, thus corresponding to the REFERENCE VALUE parameter in manual control. Separate reference values are maintained for the various displays.

The numeric suffix in TRACe<1...3> is irrelevant.

Example: "DISP:WIND1:TRAC:Y:RVAL 0" defines the display value of the reference position at 0 dB

Characteristics: *RST value: 0 Hz
0 rad (PM display)
0 PCT (AM display)
250 kHz (FM AF spectrum display)
10 rad (PM AF spectrum display)
100 PCT (AM AF spectrum display)
SCPI: device-specific

DISPlay[:WINDow<1|2>]:TRACe<1...3>:Y[:SCALe]:RPOSition 0...100PCT

This command defines the position of the reference value in the selected measurement window. The numeric suffix in TRACe<1...3> is irrelevant.

Separate reference positions are maintained for the following displays:

- RF power, RF spectrum and AF spectrum of the RF power
- FM, PM and AM
- AF spectrum of the FM, PM and A

Example: "DISP:WIND1:TRAC:Y:RPOS 50PCT"

Characteristics: *RST value: 100 PCT(level display)
50 PCT (FM, PM or AM display)
100 PCT(AF spectrum displayof the FM, PM or AM)
SCPI: conforming

DISPlay[:WINDow<1|2>]:TRACe<1...3>:Y[:SCALe]:PDIVision <numeric_value>

This command defines the scaling of the Y-axis in the current unit.

Separate scalings are maintained for the following displays:

- FM display
- PM display
- AM display
- Logarithmic AF spectrum display

The numeric suffix in TRACe<1...3> is irrelevant.

Example: `"DISP:WIND1:TRAC:Y:PDIV 10KHz"` 'Set Y scale to '10 kHz/div.

Characteristics: *RST value: *RST value: 50 kHz(FM display)
2 rad (PM display)
20 PCT (AM display)
10 dB (AF spectrum display)
SCPI: conforming

Mode: FM

This command is only available with option FS-K7 (FM Demodulator).

DISPlay[:WINDow<1|2>]:TRACe<1...3>:Y:SPACing LINear | LOGarithmic | LDB

This command switches between linear and logarithmic display in the selected window. In the case of linear display, it is also possible to switch between unit % (command `DISP:WIND:TRAC:Y:SPAC LIN`) and unit dB (command `DISP:WIND:TRAC:Y:SPAC LDB`).

In the case of AF spectrum displays, only the parameters LINear and LOGarithmic are permitted.

The numeric suffix for TRACe<1...3> is irrelevant.

Example: `"DISP:WIND1:TRAC:Y:SPAC LIN"`

Characteristics: *RST value: LOGarithmic
SCPI: conforming

INSTrument Subsystem

The INSTrument subsystem selects the operating mode of the unit either via text parameters or fixed numbers.

COMMAND	PARAMETERS	UNIT	COMMENT
INSTrument [:SELect] :NSELect	SANalyzer| ADEMod | <numeric_value>		

INSTrument[:SELect] SANalyzer | ADEMod |

This command switches between the operating modes by means of text parameters.

Parameter:

ADEMod: FM demodulator mode
SANalyzer: Spectrum analysis mode

Example: `"INST SAN"` Switch to *SPECTRUM* mode

Characteristics: *RST value: SANalyzer
SCPI: conforming

Switching to ADEMod is only possible with option FM Demodulator FS-K7 installed.

INSTrument:NSELect 1| 3

This command switches between the operating modes by means of numbers.

Parameter: 1: Spectrum analysis mode

3: FM demodulator mode

Example: `"INST:NSEL 1"` Switch to *SPECTRUM* mode

Characteristics: *RST value: 1
SCPI: conforming

SENSe Subsystem

The SENSe subsystem is organized in several subsystems. The commands of these subsystems directly control device-specific settings; they do not refer to the signal characteristics of the measurement signal.
The SENSe subsystem controls the essential parameters of the analyzer. In accordance with the SCPI standard, the keyword "SENSe" is optional for this reason, i.e. it is not necessary to include the SENSe node in command sequences.

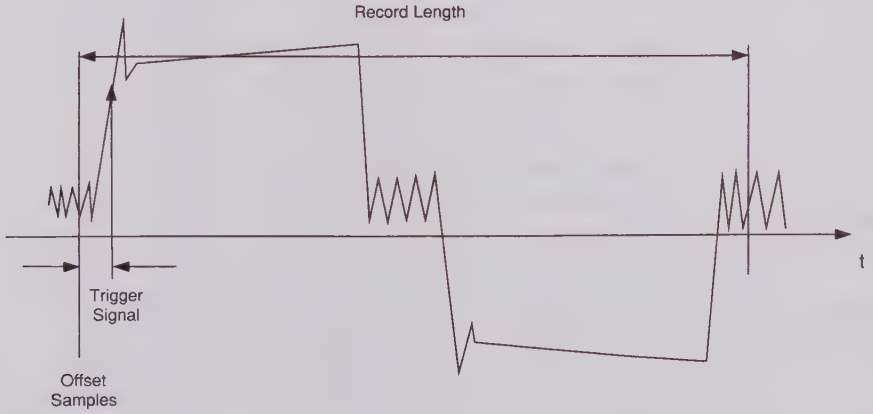
[SENSe:]ADEMod Subsystem

The purpose of the commands defined below is to set up the FSP spectrum analyzer for the measurement of FM, PM and AM modulated signals in a way that allows to obtain as many measurement results as possible with a single shot measurement.
For this purpose, the FSP has been equipped with a demodulator that is capable of performing both FM and AM demodulation at a time. Additionally maximum, minimum and average or current values can be obtained in parallel over a selected number of measurements. In order to make it suitable for bursted signals the demodulator can be configured in terms of pretrigger time, sample rate and record length.

Notes: *Demodulation will be performed offline, i.e. on signals previously stored into memory. The I/Q memory available for this purpose is 2 x 128 k samples. The sampling rate can be selected in the range from 15.625 to 32 MHz.*
The FSQ supports measurement data rates up to 64 MHz, and the option FSQ-B72 supports rates up to 256 MHz.

Example: In the case of a *Bluetooth* signal, the signal in question is described in the following diagram:

Frequency versus time:



Measurement results of interest are:

- FM offset
- FM deviation (maximum and minimum) for signal modulated with '1' values only.
- FM deviation (maximum and minimum) for signal modulated with '0' values only.
- AM modulation depth for positive and negative burst ramp.

These values can be obtained by external computations from the frequency or amplitude versus time data. For this purpose, the FSP will deliver the following results:

- Demodulated FM signal (current values, averaged, maxhold or minhold selectable)

- Demodulated AM signal (current values, averaged, maxhold or minhold selectable)
- FM offset (current value or averaged selectable)

The following settings are required on the FSP:

- Types of demodulation to be performed simultaneously (AM/FM)
- Sampling rate
- Record length
- Trigger source (free run/external)
- Pretrigger samples
- Number of measurements for average/maxhold/minhold

In addition, the required measurement results need to be configured for each type of demodulation. The FSP can simultaneously determine multiple types of demodulation with a maximum of 3 different result types. The following result types can be selected:

- WRITeThe current measurement results are determined.
- AVERageThe measurement results are averaged over a specified number of measurements
- MAXHoldThe maximum result values are determined over a specified number of measurements
- MINHoldThe minimum result values are determined over a specified number of measurements

In practice, the commands defined below are used as follows:
The instrument is set first. Then a measurement is started and the result list read in after synchronization to the end of the measurement. This method permits the control computer to be used for other tasks while the FSP is performing the measurement.

Note: *Analog demodulation is only available for screen A. Therefore, it is not permissible to enter "SENSe2..." for the commands of the SENSe:ADEMod subsystem.*

COMMAND	PARAMETERS	UNIT	COMMENT
[SENSe<1|2>]			
:ADEMod			
:AF			
:COUPling	AC | DC		
:CENTer	<numeric_value>	HZ	
:SPAN	<numeric_value>	HZ	
:FULL	--	--	
:STARt	<numeric_value>	HZ	
:STOP	<numeric_value>	HZ	
:BANDwidth			
:DEModulation	<numeric_value>	HZ	
:BWIDth			
:DEModulation	<numeric_value>	HZ	
:MTIMe	<numeric_value>	S	
:RLENgth?			query only
[:STATe]	<Boolean>		
:SET	<numeric_value>, <numeric_value>, IMMediate | EXTernal | IFPower | RFPower | AF | AM | AMRelative | FM | PM, POSitive | NEGative, <numeric_value>, <numeric_value>	HZ, --, --, --, --, --	
:SRATe?			query only
:ZOOM			
[:STATe]	<Boolean>		
:STARt	<numeric_value>	S	

[SENSe:]ADEMod:AF:COUPling AC | DC

This command selects the coupling of the AF path.

Example: `"ADEM:AF:COUP DC"` 'Switch on DC coupling.

Characteristics: *RST value: AC
SCPI: device-specific

[SENSe:]ADEMod:BANDwidth | BWIDth:DEModulation<numeric_value>

This command defines the demodulation bandwidth for analog demodulation. Depending on the selected demodulation bandwidth, the instrument selects the required sampling rate.

The available values of the demodulation bandwidths are defined by the sampling rates.

Demodulation bandwidth	Sampling rate	Comment
120 MHz	256 MHz	with FSQ-B72 only
50 MHz/ 85 MHz (1)	128 MHz	with FSQ-B72 only
30 MHz	64 MHz	with FSQ only
18 MHz	32 MHz	with FSQ only
10 MHz	32 MHz	
8 MHz	16 MHz	
5 MHz	8 MHz	
3 MHz	4 MHz	
1,6 MHz	2 MHz	
800 kHz	1 MHz	
400 kHz	500 kHz	
200 kHz	250 kHz	
100 kHz	125 kHz	
50 kHz	62.5 kHz	
25 kHz	31.25 kHz	
12.5 kHz	15.625 kHz	
6.4 kHz	7.8125 kHz	
3.2 kHz	3.90625 kHz	
1.6 kHz	1.953125 kHz	
800 Hz	976.5625 Hz	
400 Hz	488.28125 Hz	
200 Hz	244.140625 Hz	
100 Hz	122.0703125 Hz	

(1) The demodulation bandwidth at a sampling rate of 128 MHz depends on the center frequency that has been set. At a center frequency of =3.6 GHz, the demodulation bandwidth is 50 MHz; at higher center frequencies, it is 85 MHz.

Example: `"ADEM:BAND:DEM 1MHz"` Set test bandwidth to 1 MHz.

Characteristics: *RST value: 5 MHz
SCPI: device-specific

[SENSe:]ADEMod:MTIMe<numeric_value>

This command sets the measuring time for the analog demodulation.

Example: `"ADEM:MTIM 62. 5us"` 'Set measurement time to 62.5 µs.

Characteristics: *RST value: 62. 5us
SCPI: device-specific

[SENSe:]ADEMod:RLENgth?

This command returns the currently set record length for the analog demodulation.

Example: `"ADEM:RLEN?"` Return the current record length.

Characteristic: *RST value: -
SCPI: device-specific

[SENSe:]ADEMod:AF:SPAN <numeric_value>

This command sets the span for the display of the AF spectrum.

The span is limited to half the measurement bandwidth of analog demodulation (SENS:ADEM:BAND).

Example:

```
"ADEM ON"                    'Switch on FM demodulator
"CALC:FEED 'XTIM:FM:AFSP'    'Set "FM AF spectrum" display
```

or

```
"CALC:FEED 'XTIM:RFP:AFSP'   'Switch on "AF spectrum of the
                             'RF power signal" display
"ADEM:BAND 5 MHz"            'Set meas. bandwidth to 5 MHz
"ADEM:AF:CENT 500kHz"        'Set AF center frequency to 500 kHz
"ADEM:AF:SPAN 200kHz"        'Set AF span to 200 kHz
```

Characteristics: *RST value: 2.5 MHz
SCPI: device-specific

[SENSe:]ADEMod:AF:SPAN:FULL

This command sets the maximum span for the display of the AF spectrum.

The maximum span corresponds to half the measurement bandwidth of analog demodulation (SENS:ADEM:BAND).

Example:

```
"ADEM ON"                    'Switch on FM demodulator
"CALC:FEED 'XTIM:FM:AFSP'    'Switch on "FM AF spectrum" display
```

or

```
"CALC:FEED 'XTIM:RFP:AFSP'   'Switch on "AF spectrum of the
                             'RF power signal" display
"ADEM:BAND 5 MHz"            'Set meas. bandwidth to 5 MHz
"ADEM:AF:SPAN:FULL"          'Set AF span to 2.5 MHz
```

Characteristics: *RST value: -
SCPI: device-specific

[SENSe:]ADEMod:AF:CENTer <numeric_value>

This command sets the center frequency for the display of the AF spectrum.

Example:

```
"ADEM ON"                    'Switch on FM demodulator
"CALC:FEED 'XTIM:FM:AFSP'"   'Switch on "FM AF spectrum" display
```

or

```
"CALC:FEED 'XTIM:RFP:AFSP'"  'Switch on "AF spectrum of the
                             'RF power signal" display
"ADEM:BAND 5 MHz"            'Set meas. bandwidth to 5 MHz
"ADEM:AF:CENT 500kHz"        'Set AF center frequency to 500 kHz
"ADEM:AF:SPAN 200kHz"        'Set AF span to 200 kHz
```

Characteristics: *RST value: 1.25 MHz
SCPI: device-specific

[SENSe:]ADEMod:AF:STARt <numeric_value>

This command sets the start frequency for the display of the AF spectrum.

Example:

```
"ADEM ON"                    'Switch on FM demodulator
"CALC:FEED 'XTIM:FM:AFSP'"   'Switch on "FM AF spectrum" display
```

or

```
"CALC:FEED 'XTIM:RFP:AFSP'"  'Switch on "AF spectrum of the
                             'RF power signal" display
"ADEM:BAND 5 MHz"            'Set meas. bandwidth to 5 MHz
"ADEM:AF:STAR 0kHz"          'Set AF start frequency to 0 kHz
"ADEM:AF:STOP 500kHz"        'Set AF stop frequency to 500 kHz
```

Characteristics: *RST value: 0 MHz
SCPI: device-specific

[SENSe:]ADEMod:AF:STOP <numeric_value>

This command sets the stop frequency for the display of the AF spectrum.
The stop frequency is limited to half the measurement bandwidth of analog demodulation (SENS:ADEM:BAND).

Example:

```
"ADEM ON"                    'Switch on FM demodulator
"CALC:FEED 'XTIM:FM:AFSP'"   'Switch on "FM AF spectrum" display
```

or

```
"CALC:FEED 'XTIM:RFP:AFSP'"  'Switch on "AF spectrum of the
                             'RF power signal" display
"ADEM:BAND 5 MHz"            'Set meas. bandwidth to 5 MHz
"ADEM:AF:STAR 0kHz"          'Set AF start frequency to 0 kHz
"ADEM:AF:STOP 500kHz"        'Set AF stop frequency to 500 kHz
```

Characteristics: *RST value: 2.5 MHz
SCPI: device-specific

[SENSe:]ADEMod[:STATe]ON | OFF

This command switches on the FM demodulator of the instrument. The instrument will be set to time-domain measurement (span = 0) at the current center frequency.

Note: *The measurement is always performed in screen A. Split-screen operation will be switched off as soon as the demodulator is activated.*

Example: `"ADEM ON"` Switch on the FM demodulator

Characteristics: *RST value: OFF
SCPI: device-specific

[SENSe:]ADEMod:SET<sample rate>,<record length>,<trigger source>,<trigger slope>, <offset samples>,<# of meas>

This command configures the FM demodulator of the FSP.

Parameter:

<sample rate>: Frequency at which measured values are taken from the A/D converter and stored in I/Q memory.
Value range: 122.0703125 Hz, 244.140625 Hz, 488.28125 Hz, 976.5625 Hz,
1.953125 kHz, 3.90625 kHz, 7.8125 kHz,
15.625 kHz, 31.25 kHz, 62.5 kHz, 125 kHz,
250 kHz, 500 kHz,
1 MHz, 2 MHz, 4 MHz, 8 MHz, 16 MHz, 32 MHz

<record length>: Number of samples to be stored in I/Q memory.
Value range: 1 to 130560 (128 * 1024 - 512)

<trigger source>: Selection of the trigger source for the demodulator.
Valid values: IMMediate | EXTernal IFPower | FM | AM | AMRelative | PM

<trigger slope>: Trigger slope selected.
Valid values: POSitive | NEGative
The value indicated here will be ignored for <trigger source> = IMMediate.

<offset samples>: Number of samples to be used as an offset to the trigger signal.
Value range: -65024 to 130560 (= -64 * 1024 + 512 to128 * 1024 - 512)
The indicated value is ignored for <trigger source> = IMMediate

<# of meas>: Number of measurements. The value indicated here is particularly necessary for the AVERage/MAXHold/MINHold function.
Value range: 0 to 32767

Example: `ADEM:SET 8MHz,32000,EXT,POS,-500,30`
will perform a measurement with the following settings:

sample rate	= 8 MHz
record length	= 32000
trigger source	= EXTernal
trigger slope	= POSitive
offset samples	= -500 (= 500 samples before trigger occurs)
# of meas	= 30

Characteristics: *RST values: sample rate= 8 MHz
record length= 501
trigger source = IMMediate
trigger slope = POSitive
offset samples = 0
# of meas = 0

SCPI: device-specific

[SENSe:]ADEMod:SRATe?

This command returns the currently set sampling rate for the analog demodulation.

Example: `"ADEM:SRAT?"` Return the current sampling rate.

Characteristics: *RST value: -
SCPI: device-specific

[SENSe:]ADEMod:ZOOM[:STATe>] ON | OFF

This command switches the zoom function for the measurement data of the FM demodulator on or off. Depending on the selected measurement time and demodulation bandwidth, more measurement points are captured than can be shown on the display.

If the zoom function has been switched on, exactly 501 (FSP) or 625 (FSU and FSQ) measurement points from the measured value memory will be shown starting at the time defined with [SENS:]ADEM:ZOOM:STARt.

If the zoom function has been switched off, all measurement points will be compressed down to the number of points available on the display by means of data reduction.

Example: `"ADEM:ZOOM ON"` Switch on the zoom function.

Characteristics: *RST value: OFF
SCPI: device-specific

[SENSe:]ADEMod:ZOOM:STARt 0 s to measurement time

This command selects the start time for displaying the individual measurement values of the FM demodulator. The maximum value depends on the measurement time set in the instrument; this value can be queried with ADEM:ZOOM:START? MAX.
If the zoom function has been switched on, 501 (FSP) or 625 (FSU and FSQ) measurement points will be displayed starting at the time that has been set.

Example: `"ADEM:ZOOM ON"` Switch on zoom function
`"ADEM:ZOOM:STAR 500us"` Set display starting point to 500 µs

Characteristics: *RST value: 0 s
SCPI: device-specific

[SENSe:]ADEMod:AM Subsystem

COMMAND	PARAMETERS	UNIT	COMMENT
[SENSe<1|2>]			
:ADEMod			
:AM			
[:ABSolute]			
[:TDOMain]			
[:TYPE]	WRITe | AVERage | MAXHold | MINHold | VIEW | OFF, WRITe | AVERage | MAXHold | MINHold | VIEW | OFF, WRITe | AVERage | MAXHold | MINHold | VIEW | OFF		
:RESult?	WRITe | AVERage | MAXHold | MINHold		
:AFSPectrum			
[:TYPE]	WRITe | AVERage | MAXHold | MINHold | VIEW | OFF, WRITe | AVERage | MAXHold | MINHold | VIEW | OFF, WRITe | AVERage | MAXHold | MINHold | VIEW | OFF		
:RESult?	WRITe | AVERage | MAXHold | MINHold		
:RELative			
[:TDOMain]			
[:TYPE]	WRITe | AVERage | MAXHold | MINHold | VIEW | OFF, WRITe | AVERage | MAXHold | MINHold | VIEW | OFF, WRITe | AVERage | MAXHold | MINHold | VIEW | OFF		
:RESult?	WRITe | AVERage | MAXHold | MINHold		
:AFSPectrum			
[:TYPE]	WRITe | AVERage | MAXHold | MINHold | VIEW | OFF, WRITe | AVERage | MAXHold | MINHold | VIEW | OFF, WRITe | AVERage | MAXHold | MINHold | VIEW | OFF		
:RESult?	WRITe | AVERage | MAXHold | MINHold		

SENSe:]ADEMod:AM[[:ABSolute][:TDOMain]:TYPE] <result type 1>,<result type 2>,<result type 3>

This command selects the result types to be measured in parallel by AM demodulation.

Parameter:

<result type 1/2/3>:

WRITe	The current measured values are recorded.
AVERage	The measurement results are averaged over the specified number of measurements.
MAXHold	The maximum result over the specified number of measurements is obtained.
MINHold	The minimum result over the specified number of measurements is obtained.
VIEW	The measurement result is frozen on the display, i.e. it is not recalculated in further measurements.
OFF	The result type is not used.

Notes:

Settings different from OFF can be assigned to only one result type at a time.

Together with other signals, a maximum of six traces can be activated simultaneously. For example, three FM and three PM result types can be activated simultaneously.

The AM demodulator is deactivated by setting all result types to OFF.

Examples:

`ADEM:AM`	`AVER,MAXH,MINH`	Determine average, maximum and minimum value simultaneously
`ADEM:AM`	`WRIT,OFF,OFF`	Determine the current measured values only
`ADEM:AM`	`OFF,OFF,OFF`	Switch off the calculation of the RF signal in the time domain

Characteristics: *RST values: WRITe,OFF,OFF

SCPI: Device-specific

[SENSe:]ADEMod:AM[:ABSolute][:TDOMain]:RESult?<result type>

This command reads the result data obtained by AM demodulation depending on the type indicated as a parameter. The data format of the output data is defined by the FORMat command.

Note:
Traces cannot be queried when VIEW is active.

Parameter:

<result type>:

WRITe	The current measured values are recorded.
AVERage	The measurement results averaged over the specified number of measurements are obtained.
MAXHold	The maximum result is determined over the specified number of measurements.
MINHold	The minimum result is determined over the specified number of measurements.

Note:
The result type indicated must be one that was configured with the command [SENSe:]ADEMod:AM[:ABSolute][:TDOMain] [:TYPE]. Otherwise, a query error will be generated.

Return values:

ASCII format (FORMat ASCII):

In this case, the command will return a list of comma-separated values (CSV) of the measured values in floating point format. The output unit is dBm (logarithmic display) or V (linear display).

Binary format (FORMat REAL,32):

In this case, the command will return binary data (Definite Length Block Data according to IEEE 488.2), with each measured value formatted in 32-bit IEEE 754 floating point format. The response string will have the following structure:

#41024<value1><value2>...<value n>

with

#4	Number of digits in the following number of data bytes (= 4 in the example)
1024	Number of following data bytes (*# of DataBytes*, = 1024 in the example)
<value x>	4-byte floating point value

Examples:

```
ADEM:SET 8MHz,32000,EXT,POS,-500,30  'Set up demodulator parameters
ADEM:FAM AVER,MAXH,MINH              'Select results to measure
ADEM ON                              'Switch on demodulator
INIT;*WAI                            'Start measurement and wait for end
FORM ASC                             'Select output format
ADEM:FM:RES? AVER                    'Read average results
ADEM:FM:RES? MAXH                    'Read MAXHold results
ADEM:FM:RES? MINH                    'Read MINHold results
```

Characteristics: *RST value: -
SCPI: device-specific

[SENSe:]ADEMod:AM[:ABSolute]:AFSPectrum[:TYPE] <result type 1>,<result type 2>,<result type 3>

This command selects the AF spectrum result types of the RF signal in the time domain to be measured simultaneously.

Parameters: <result type 1/2/3>:

WRITe	The current measured values are recorded.
AVERage	The measurement results are averaged over the specified number of measurements.
MAXHold	The maximum result over the specified number of measurements is determined.
MINHold	The minimum result over the specified number of measurements is determined.
VIEW	The measurement result is frozen on the display, i.e. it is not recalculated in further measurements.
OFF	The result type is not used.

Note:
Settings different from OFF can be assigned to only one result type at a time.
Together with other signals, a maximum of six traces can be activated simultaneously. For example, three FM and three PM result types can be activated simultaneously.

If all result types are set to OFF, no AF spectrum of the RF signal in the time domain will be calculated.
The result type AF spectrum of the RF signal in the time domain cannot be activated simultaneously with other AF spectra.

Examples:

`ADEM:AM:AFSP`	`AVER,MAXH,MINH`	Determine average, maximum and minimum simultaneously
`ADEM:AM:AFSP`	`WRIT,OFF,OFF`	Determine only the current measurement results
`ADEM:AM:AFSP`	`OFF,OFF,OFF`	Switch off calculation of the AF spectrum

Characteristics: *RST values: OFF,OFF,OFF
SCPI: device-specific

[SENSe:]ADEMod:AM[:ABSolute]:AFSPectrum:RESult? <result type>

This command reads out the result data of the AF spectrum of the RF signal in the time domain for the specified result type. The format of the output data is defined using the FORMat command.

Note: *Traces cannot be queried when VIEW is active.*

Parameters: <result type>:

WRITe	The current measured values are returned.
AVERage	The measurement results averaged over the specified number of measurements are returned.
MAXHold	The maximum result over the specified number of measurements is returned.
MINHold	The minimum result over the specified number of measurements is returned.

Note: *The specified result type must be one that was configured with the command [SENSe:]ADEMod:AM[:ABSolute]:AFSPectrum[:TYPE]. Otherwise, a query error will be generated.*

Return values:

ASCII format (FORMat ASCII):

In this case, the command will return a list of comma-separated values (CSV) of the measured values in floating point format. The output unit is dBm (logarithmic display) or V (linear display).

Binary format (FORMat REAL,32):

In this case, the command will return binary data (Definite Length Block Data according to IEEE 488.2), with each measured value formatted in 32-bit IEEE 754 floating point format. The response string will have the following structure:

#41024<value1><value2>...<value n>
where

#4	Number of digits in the following number of data bytes (= 4 in the example)
1024	Number of following data bytes *(# of DataBytes* = 1024 in the example)
<value x>	4-byte floating point value

Examples:

```
ADEM:SET 8MHz,32000,EXT,POS,-500,30      'Set demodulator
ADEM:FM AVER,MAXH,MINH                   'Select FM results to be measured
ADEM:AM WRIT,OFF,OFF                     'Select results of the RF signal to be
                                         'measured in the time domain
ADEM:AM:AFSP WRIT,OFF,OFF                'Select the AF spectrum results of the
                                         'RF signal to be measured in the time
                                         'domain
ADEM ON                                  'Switch on demodulator
INIT;*WAI                                'Start measurement and wait for end
FORM ASC                                 'Select output format
ADEM:FM:RES? AVER                        'Read FM average value result data
ADEM:FM:RES? MAXH                        'Read FM MAXHold result data
ADEM:FM:RES? MINH                        'Read FM MINHold result data
ADEM:AM:RES? WRIT                        'Read current AM result data
ADEM:AM:AFSP:RES? WRIT                   'Read current AF spectrum result
                                         'data of the RF signal in the time
                                         'domain
```

Characteristics:

*RST value:	-
SCPI:	device-specific

[SENSe:]ADEMod:AM:RELative[:TDOMain][:TYPE] <result type 1>,<result type 2>,<result type 3>

This command selects the result types to be measured simultaneously in the case of AM demodulation.

Parameter:

<result type 1/2/3>:

WRITe	The current measured values are recorded.
AVERage	The measurement results are averaged over the specified number of measurements.
MAXHold	The maximum result over the specified number of measurements is determined.
MINHold	The minimum result over the specified number of measurements is determined.
VIEW	The measurement result is frozen on the display, i.e. it is not recalculated in further measurements.
OFF	The result type is not used.

Notes:

Settings different from OFF can be assigned to only one result type at a time.

Together with other signals, a maximum of six traces can be activated simultaneously. For example, three FM and three PM result types can be activated simultaneously

If all result types are set to OFF, the AM demodulator will be switched off.

Examples:

`ADEM:AM:REL`	`AVER,MAXH,MINH`	Determine average, maximum and minimum value simultaneously
`ADEM:AM:REL`	`WRIT,OFF,OFF`	Determine only the current measured values
`ADEM:AM:REL`	`OFF,OFF,OFF`	Switch off the AM demodulator

Characteristics: *RST values: WRITe,OFF,OFF

SCPI: device-specific

[SENSe:]ADEMod:AM:RELative[:TDOMain]:RESult?<result type>

This command reads out the result data of the AM demodulation for the specified result type. The format of the output data is defined using the FORMat command.

Note: *Traces cannot be queried when VIEW is active.*

<result type>:

WRITe	The current measured values are returned.
AVERage	The measurement results averaged over the specified number of measurements are returned.
MAXHold	The maximum result over the specified number of measurements is returned.
MINHold	The minimum result over the specified number of measurements is returned.

Note: *The specified result type must be one that was configured with the command [SENSe:]ADEMod:AM:RELative[:TDOMain][:TYPE]. Otherwise, a query error will be generated.*

Return values:

ASCII format (FORMat ASCII):

In this case, the command will return a list of comma-separated values (CSV) of the measured values in floating point format. The output unit is %.

Binary format (FORMat REAL,32):

In this case, the command will return binary data (Definite Length Block Data according to IEEE 488.2), with each measured value formatted in 32-bit IEEE 754 floating point format. The response string will have the following structure:

#41024<value1><value2>...<value n>

where

#4	Number of digits in the following number of data bytes (= 4 in the example)
1024	Number of following data bytes *(# of DataBytes* = 1024 in the example)
<value x>	4-byte floating point value

Examples:

```
ADEM:SET 8MHz,32000,EXT,POS,-500,30  'Set demodulator
ADEM:FM AVER,MAXH,MINH               'Select FM results to be measured
ADEM:AM:REL WRIT,OFF,OFF             'Select AM results to be measured
ADEM ON                              ' Switch on demodulator
INIT;*WAI                            ' Start measurement and wait for end
FORM ASC                             ' Select output format
ADEM:FM:RES? AVER                    ' Read FM average result data
ADEM:FM:RES? MAXH                    ' Read FM MAXHold result data
ADEM:FM:RES? MINH                    ' Read FM MINHold result data
ADEM:AM:REL:RES? WRIT                'Read current AM result data
```

Characteristics: *RST value: -
SCPI: device-specific

[SENSe:]ADEMod:AM:RELative:AFSPectrum[:TYPE] <result type 1>,<result type 2>,<result type 3>

This command selects the AF spectrum result types of the AM-demodulated signal to be measured simultaneously.

Parameter: <result type 1/2/3>:

WRITe	The current measured values are recorded.
AVERage	The measurement results are averaged over the specified number of measurements.
MAXHold	The maximum result over the specified number of measurements is determined.
MINHold	The minimum result over the specified number of measurements is determined.
VIEW	The measurement result is frozen on the display, i.e. it is not recalculated in further measurements.
OFF	The result type is not used.

Notes:

Settings different from OFF can be assigned to only one result type at a time.
Together with other signals, a maximum of six traces can be activated simultaneously. For example, three FM and three PM result types can be activated simultaneously.

If all result types are set to OFF, no AF spectrum of the AM-demodulated signal will be calculated.
The result type AF spectrum of the AM-demodulated signal cannot be activated simultaneously with other AF spectra.

Examples:

`ADEM:AM:REL:AFSP`	`AVER,MAXH,MINH`	Determine average, maximum and minimum value simultaneously
`ADEM:AM:REL:AFSP`	`WRIT,OFF,OFF`	Determine only the current measured values
`ADEM:AM:REL:AFSP`	`OFF,OFF,OFF`	Switch off calculation of the AF spectrum

Characteristics: *RST values: OFF,OFF,OFF
SCPI: device-specific

[SENSe:]ADEMod:AM:RELative:AFSPectrum:RESult? <result type>

This command reads out the result data of the AF spectrum of the AM-demodulated signal for the specified result type. The format of the output data is defined using the FORMat command.

Note: *Traces cannot be queried when VIEW is active.*

Parameter: <result type>:

WRITe	The current measured values are returned.
AVERage	The measurement results averaged over the specified number of measurements are returned.
MAXHold	The maximum result over the specified number of measurements is returned.
MINHold	The minimum result over the specified number of measurements is returned.

Note: *The specified result type must be one that was configured with the command [SENSe:]ADEMod:AM:RELative:AFSPectrum[:TYPE]. Otherwise, a query error will be generated.*

Return values:

ASCII format (FORMat ASCII):

In this case, the command will return a list of comma-separated values (CSV) of the measured values in floating point format. The output unit is dBm (logarithmic display) or % (linear display).

Binary format (FORMat REAL,32):

In this case, the command will return binary data (Definite Length Block Data according to IEEE 488.2), with each measured value formatted in 32-bit IEEE 754 floating point format. The response string will have the following structure:

#41024<value1><value2>...<value n>
where

#4	Number of digits in the following number of data bytes (= 4 in the example)
1024	Number of following data bytes *(# of DataBytes* = 1024 in the example)
<value x>	4-byte floating point value

Examples:

```
ADEM:SET 8MHz,32000,EXT,POS,-500,30      'Set demodulator
ADEM:FM AVER,MAXH,MINH                   'Select the FM results to be
                                         'measured
ADEM:AM:REL WRIT,OFF,OFF                 'Select the AM results to be
                                         'measured
ADEM:AM:REL:AFSP WRIT,OFF,OFF            'Select the AF spectrum results of the
                                         'demodulated AM signal to be measured
ADEM ON                                  'Switch on demodulator
INIT;*WAI                                'Start measurement and wait for end
FORM ASC                                 'Select output format
ADEM:FM:RES? AVER                        'Read FM average value result data
ADEM:FM:RES? MAXH                        'Read FM MAXHold result data
ADEM:FM:RES? MINH                        'Read FM MINHold result data
ADEM:AM:REL:RES? WRIT                    'Read current AM result data
ADEM:AM:REL:AFSP:RES? WRIT               'Read current AF spectrum result
                                         'data of the demodulated AM signal
```

Characteristics:

*RST value:	-
SCPI:	device-specific

[SENSe:]ADEMod:FM Subsystem

COMMAND	PARAMETERS	UNIT	COMMENT
[SENSe<1|2>]			
:ADEMod			
:FM			
[:TDOMain]			
[:TYPE]	WRITe | AVERage | MAXHold | MINHold | VIEW | OFF, WRITe | AVERage | MAXHold | MINHold | VIEW | OFF, WRITe | AVERage | MAXHold | MINHold | VIEW | OFF		
:RESult?	WRITe | AVERage | MAXHold | MINHold		
:AFSPectrum			
[:TYPE]	WRITe | AVERage | MAXHold | MINHold | VIEW | OFF, WRITe | AVERage | MAXHold | MINHold | VIEW | OFF, WRITe | AVERage | MAXHold | MINHold | VIEW | OFF		
:RESult?	WRITe | AVERage | MAXHold | MINHold		
:OFFSet?	IMMediate | AVERage		

[SENSe:]ADEMod:FM[:TDOMain] [:TYPE]<result type 1>,<result type 2>,<result type 3>

This command selects the result types to be created in parallel by FM demodulation.

Parameters:

<result type 1/2/3>:

WRITe	The current measured values are recorded.
AVERage	The measurement results are averaged over the specified number of measurements.
MAXHold	The maximum result is determined over the specified number of measurements.
MINHold	The minimum result is determined over the specified number of measurements.
VIEW	The measurement result is frozen on the display, i.e. it is not recalculated in further measurements.
OFF	The result type is not used.

Notes:

Settings different from OFF can be assigned to only one result type at a time.

Together with other signals, a maximum of six traces can be activated simultaneously. For example, three FM and three PM result types can be activated simultaneously.

The FM demodulator is deactivated by setting all result types to OFF.

Examples:

`ADEM:FM AVER,MAXH,MINH`	Determine average, maximum and minimum value simultaneously
`ADEM:FM WRIT,OFF,OFF`	Determine only the current measurement result
`ADEM:FM OFF,OFF,OFF`	Switch off the FM demodulator

Characteristics: *RST values: WRITe,OFF,OFF
SCPI: device-specific

[SENSe:]ADEMod:FM[:TDOMain]:RESult?<result type>

This command reads the result data obtained by FM demodulation depending on the type indicated as a parameter. The data format of the output data is defined by the FORMat command.

Note: *Traces cannot be queried when VIEW is active.*

Parameter:

<result type>:

WRITe	The current trace data is recorded.
AVERage	The measurement results averaged over the specified number of measurements are obtained.
MAXHold	The maximum result is determined over the specified number of measurements.
MINHold	The minimum result is determined over the specified number of measurements.

Note:

The specified result type must be one that was configured with the command [SENSe:]ADEMod:FM[:TYPE]. Otherwise, a query error will be generated.

Return values:

ASCII format (FORMat ASCII):

In this case, the command will return a list of comma-separated values (CSV) of the measured values in floating point format. The output unit is Hz.

Binary format (FORMat REAL,32):

In this case, the command will return binary data (Definite Length Block Data according to IEEE 488.2), with each measured value formatted in 32-bit IEEE 754 floating point format. The response string will have the following structure:

#41024<value1><value2>...<value n>

with

#4	Number of digits (= 4 in the example) of the following number of data bytes
1024	Number of following data bytes *(# of DataBytes* = 1024 in the example)
<value x>	4-byte floating point value

Examples:

```
ADEM:SET 8MHz,32000,EXT,POS,-500,30      'Set demodulator 'parameters
ADEM:FM AVER,MAXH,MINH                   'Select FM results to measure
ADEM:AM WRIT,OFF,OFF                     'Select AM results to measure
ADEM ON                                  'Switch on demodulator
INIT;*WAI                                'Start measurement and wait
                                         'for end
FORM ASC                                 'Select output format
ADEM:FM:RES? AVER                        'Read FM average results
ADEM:FM:RES? MAXH                        'Read FM MAXHold results
ADEM:FM:RES? MINH                        'Read FM MINHold result data
ADEM:AM:RES? WRIT                        'Read current AM results
```

Characteristics: *RST value: -
SCPI: device-specific

[SENSe:]ADEMod:FM:AFSPectrum[:TYPE] <result type 1>,<result type 2>,<result type 3>

This command selects the AF spectrum result types of the FM-demodulated signal to be measured simultaneously.

Parameter: <result type 1/2/3>:

WRITe	The current measured values are recorded.
AVERage	The measurement results are averaged over the specified number of measurements.
MAXHold	The maximum result over the specified number of measurements is determined.
MINHold	The minimum result over the specified number of measurements is determined.
VIEW	The measurement result is frozen on the display, i.e. it is not recalculated in further measurements.
OFF	The result type is not used.

Notes:

Settings different from OFF can be assigned to only one result type at a time.

Together with other signals, a maximum of six traces can be activated simultaneously. For example, three FM and three PM result types can be activated simultaneously.

If all result types are set to OFF, no AF spectrum of the FM-demodulated signal will be calculated.

The result type AF spectrum of the FM-demodulated signal cannot be activated simultaneously with other AF spectra.

Examples:

`ADEM:FM:AFSP`	`AVER,MAXH,MINH`	Determine average, maximum and minimum value simultaneously
`ADEM:FM:AFSP`	`WRIT,OFF,OFF`	Determine only the current measured values
`ADEM:FM:AFSP`	`OFF,OFF,OFF`	Switch off calculation of the AF spectrum

Characteristics: *RST values: OFF,OFF,OFF
SCPI: device-specific

[SENSe:]ADEMod:FM:AFSPectrum:RESult? <result type>

This command reads out the result data of the AF spectrum of the FM-demodulated signal for the specified result type. The format of the output data is defined using the FORMat command.

Note:
Traces cannot be queried when VIEW is active.

Parameter: <result type>:

WRITe	The current measured values are returned.
AVERage	The measurement results averaged over the specified number of measurements are returned.
MAXHold	The maximum result over the specified number of measurements is returned.
MINHold	The minimum result over the specified number of measurements is returned.

Note:

The specified result type must be one that was configured with the command [SENSe:]ADEMod:FM:AFSPectrum[:TYPE]. Otherwise, a query error will be generated.

Return values:

ASCII format (FORMat ASCII):

In this case, the command will return a list of comma-separated values (CSV) of the measured values in floating point format. The output unit is dBm (logarithmic display) or V (linear display).

Binary format (FORMat REAL,32):

In this case, the command will return binary data (Definite Length Block Data according to IEEE 488.2), with each measured value formatted in 32-bit IEEE 754 floating point format. The response string will have the following structure:

#41024<value1><value2>...<value n>
where

#4	Number of digits in the following number of data bytes (= 4 in the example)
1024	Number of following data bytes *(# of DataBytes* = 1024 in the example)
<value x>	4-byte floating point value

Examples:

```
ADEM:SET 8MHz,32000,EXT,POS,-500,30      'Set demodulator
ADEM:FM AVER,MAXH,MINH                   'Select FM results to be measured
ADEM:AM:REL WRIT,OFF,OFF                 'Select AM results to be measured
ADEM:FM:AFSP WRIT,OFF,OFF                'Select AF spectrum results of the
                                         'demodulated FM signal to be
                                         'measured
ADEM ON                                  'Switch on demodulator
INIT;*WAI                                'Start measurement and wait for end
FORM ASC                                 'Select output format
ADEM:FM:RES? AVER                        'Read FM average result data
ADEM:FM:RES? MAXH                        'Read FM MAXHold result data
ADEM:FM:RES? MINH                        'Read FM MINHold result data
ADEM:AM:RES? WRIT                        'Read current AM result data
ADEM:FM:AFSP:RES? WRIT                   'Read current AF spectrum result data
                                         'of the demodulated FM signal
```

Characteristics: *RST value: -
SCPI: device-specific

[SENSe:]ADEMod:FM:OFFSet?<result type>

This command calculates the FM offset of the current measured data set.

If averaging has been activated prior to data acquisition (using the command [SENSe:]ADEMod:FM [:TYPE]), the average FM offset can also be obtained by setting <result type> = AVERage. The average FM offset obtained in this way differs from the one calculated by CALC:MARK:FUNC:ADEM:FERR?, since, for determination of the frequency deviation, the modulation is removed by means of lowpass filtering, producing results that are different from those obtained by averaging.

Parameters:

<result type>:

IMMediate	The current measurement results are used for calculating the FM offset.
AVERage	The measurement results averaged over the specified number of measurements are used for calculation of the FM offset.

Notes:

If no average measurement has been active during the last measurement sequence, only the command [SENSe:]ADEMod:FM:OFFSet? IMMediate will return a valid result (data to calculate the FM offset are taken from the last measured data set).

[SENSe:]ADEMod:FM:OFFSet? AVERage will cause a query error in this case.

Example:

```
ADEM:SET 8MHz,32000,EXT,POS,-500,30      'Set demodulator to perform
                                         '30 measurements
ADEM:FM AVER,OFF,OFF                     'Set FM results to perform
                                         'averaging
ADEM:AM OFF,OFF,OFF                      'Switch off AM demodulation
ADEM ON                                  'Switch on FM demodulator
INIT;*WAI                                'Start measurement and wait
                                         'for end
ADEM:FM:OFFS? IMM                        'Read FM offset of last
                                         'measurement of the sequence
                                         'of 30
ADEM:FM:OFFS? AVER                       'Read FM offset averaged
                                         'over 30 measurements
```

Characteristics: *RST value: -

SCPI: device-specific

[SENSe:]ADEMod:PM Subsystem

COMMAND	PARAMETERS	UNIT	COMMENT
[SENSe<1|2>]			
:ADEMod			
:PM			
[:TDOMain]			
[:TYPE]	WRITe | AVERage | MAXHold | MINHold | VIEW | OFF, WRITe | AVERage | MAXHold | MINHold | VIEW | OFF, WRITe | AVERage | MAXHold | MINHold | VIEW | OFF		
:RESult?	WRITe | AVERage | MAXHold | MINHold		
:AFSPectrum			
[:TYPE]	WRITe | AVERage | MAXHold | MINHold | VIEW | OFF, WRITe | AVERage | MAXHold | MINHold | VIEW | OFF, WRITe | AVERage | MAXHold | MINHold | VIEW | OFF		
:RESult?	WRITe | AVERage | MAXHold | MINHold		
:OFFSet?	IMMediate | AVERage		

[SENSe:]ADEMod:PM[:TDOMain] [:TYPE]<result type 1>,<result type 2>,<result type 3>

This command selects the result types to be created in parallel by PM demodulation.

Parameters:

<result type 1/2/3>:

WRITe	The current measured values are recorded.
AVERage	The measurement results are averaged over the specified number of measurements.
MAXHold	The maximum result is determined over the specified number of measurements.
MINHold	The minimum result is determined over the specified number of measurements.
VIEW	The measurement result is frozen on the display, i.e. it is not recalculated in further measurements.
OFF	The result type is not used.

Notes:

Settings different from OFF can be assigned to only one result type at a time.

Together with other signals, a maximum of six traces can be activated simultaneously. For example, three PM and three PM result types can be activated simultaneously.

The PM demodulator is deactivated by setting all result types to OFF.

Examples:

`ADEM:PM AVER,MAXH,MINH`	Determine average, maximum and minimum value simultaneously
`ADEM:PM WRIT,OFF,OFF`	Determine only the current measurement result
`ADEM:PM OFF,OFF,OFF`	Switch off the PM demodulator

Characteristics: *RST values: WRITe,OFF,OFF
SCPI: device-specific

[SENSe:]ADEMod:PM[:TDOMain]:RESult?<result type>

This command reads the result data obtained by PM demodulation depending on the type indicated as a parameter. The data format of the output data is defined by the FORMat command.

Note: *Traces cannot be queried when VIEW is active.*

Parameter:

<result type>:

WRITe	The current trace data is recorded.
AVERage	The measurement results averaged over the specified number of measurements are obtained.
MAXHold	The maximum result is determined over the specified number of measurements.
MINHold	The minimum result is determined over the specified number of measurements.

Note: *The specified result type must be one that was configured with the command [SENSe:]ADEMod:PM[:TYPE]. Otherwise, a query error will be generated.*

Return values:

ASCII format (FORMat ASCII):

In this case, the command will return a list of comma-separated values (CSV) of the measured values in floating point format. The output unit depends on the unit selected - either RAD or DEG.

Binary format (FORMat REAL,32):

In this case, the command will return binary data (Definite Length Block Data according to IEEE 488.2), with each measured value formatted in 32-bit IEEE 754 floating point format. The response string will have the following structure:

#41024<value1><value2>...<value n>

with

#4	Number of digits (= 4 in the example) of the following number of data bytes
1024	Number of following data bytes *(# of DataBytes* = 1024 in the example)
<value x>	4-byte floating point value

Examples:

```
ADEM:SET 8MHz,32000,EXT,POS,-500,30     'Set demodulator 'parameters
ADEM:PM AVER,MAXH,MINH                  'Select PM results to measure
ADEM:AM WRIT,OFF,OFF                    'Select AM results to measure
ADEM ON                                 'Switch on demodulator
INIT;*WAI                               'Start measurement and wait
                                        'for end
FORM ASC                                'Select output format
ADEM:PM:RES? AVER                       'Read PM average results
ADEM:PM:RES? MAXH                       'Read PM MAXHold results
ADEM:PM:RES? MINH                       'Read PM MINHold result data
ADEM:AM:RES? WRIT                       'Read current AM results
```

Characteristics: *RST value: -
SCPI: device-specific

[SENSe:]ADEMod:PM:AFSPectrum[:TYPE] <result type 1>,<result type 2>,<result type 3>

This command selects the AF spectrum result types of the PM-demodulated signal to be measured simultaneously.

Parameter: <result type 1/2/3>:

WRITe	The current measured values are recorded.
AVERage	The measurement results are averaged over the specified number of measurements.
MAXHold	The maximum result over the specified number of measurements is determined.
MINHold	The minimum result over the specified number of measurements is determined.
VIEW	The measurement result is frozen on the display, i.e. it is not recalculated in further measurements.
OFF	The result type is not used.

Notes:

Settings different from OFF can be assigned to only one result type at a time.

Together with other signals, a maximum of six traces can be activated simultaneously. For example, three PM and three PM result types can be activated simultaneously.

If all result types are set to OFF, no AF spectrum of the PM-demodulated signal will be calculated.

The result type AF spectrum of the PM-demodulated signal cannot be activated simultaneously with other AF spectra.

Examples:

`ADEM:PM:AFSP`	`AVER,MAXH,MINH`	Determine average, maximum and minimum value simultaneously
`ADEM:PM:AFSP`	`WRIT,OFF,OFF`	Determine only the current measured values
`ADEM:PM:AFSP`	`OFF,OFF,OFF`	Switch off calculation of the AF spectrum

Characteristics: *RST values: OFF,OFF,OFF
SCPI: device-specific

[SENSe:]ADEMod:PM:AFSPectrum:RESult? <result type>

This command reads out the result data of the AF spectrum of the PM-demodulated signal for the specified result type. The format of the output data is defined using the FORMat command.

Note:
Traces cannot be queried when VIEW is active.

Parameter: <result type>:

WRITe	The current measured values are returned.
AVERage	The measurement results averaged over the specified number of measurements are returned.
MAXHold	The maximum result over the specified number of measurements is returned.
MINHold	The minimum result over the specified number of measurements is returned.

Note:

The specified result type must be one that was configured with the command [SENSe:]ADEMod:PM:AFSPectrum[:TYPE]. Otherwise, a query error will be generated.

Return values:

ASCII format (FORMat ASCII):

In this case, the command will return a list of comma-separated values (CSV) of the measured values in floating point format. The output unit is dB (logarithmic display) or depends on the unit selected - either RAD or DEG (linear display).

Binary format (FORMat REAL,32):

In this case, the command will return binary data (Definite Length Block Data according to IEEE 488.2), with each measured value formatted in 32-bit IEEE 754 floating point format. The response string will have the following structure:

#41024<value1><value2>...<value n>
where

#4	Number of digits in the following number of data bytes (= 4 in the example)
1024	Number of following data bytes *(# of DataBytes* = 1024 in the example)
<value x>	4-byte floating point value

Examples:

```
ADEM:SET 8MHz,32000,EXT,POS,-500,30      'Set demodulator
ADEM:PM AVER,MAXH,MINH                   'Select PM results to be measured
ADEM:AM:REL WRIT,OFF,OFF                 'Select AM results to be measured
ADEM:PM:AFSP WRIT,OFF,OFF                'Select AF spectrum results of the
                                         'demodulated PM signal to be
                                         'measured
ADEM ON                                  'Switch on demodulator
INIT;*WAI                                'Start measurement and wait for end
FORM ASC                                 'Select output format
ADEM:PM:RES? AVER                        'Read PM average result data
ADEM:PM:RES? MAXH                        'Read PM MAXHold result data
ADEM:PM:RES? MINH                        'Read PM MINHold result data
ADEM:AM:RES? WRIT                        'Read current AM result data
ADEM:PM:AFSP:RES? WRIT                   'Read current AF spectrum result data
                                         'of the demodulated PM signal
```

Characteristics: *RST value: -
SCPI: device-specific

[SENSe:]ADEMod:PM:RPOint[:X] 0s to measurement time

This command determines the position where the phase of the PM-demodulated signal is set to 0 rad. The maximum possible value depends on the measurement time selected in the instrument; this value is output in response to the query ADEM:PM:RPO:X? MAX.

Example: "ADEM:PM:RPO:X 500us" Set the position where the phase to 0 rad setting to 500 µs.

Characteristics: *RST value 0 s
SCPI: conforming

[SENSe:]ADEMod:SPECtrum - Subsystem

COMMAND	PARAMETERS	UNIT	COMMENT
[SENSe<1|2>]			
:ADEMod			Option FM-Demodulator
:SPECtrum			
:BANDwidth			
[:RESolution]	<numeric_value>	HZ	
:BWIDth			
[:RESolution]	<numeric_value>	HZ	
:SPAN			
[:MAXimum]	<numeric_value>	HZ	
:ZOOM	<numeric_value>	HZ	
[:TYPE]	WRITe | AVERage | MAXHold | MINHold | VIEW | OFF, WRITe | AVERage | MAXHold | MINHold | VIEW | OFF, WRITe | AVERage | MAXHold | MINHold | VIEW | OFF		
:RESult?	WRITe | AVERage | MAXHold | MINHold		

[SENSe:]ADEMod:SPECtrum:BANDwidth|BWIDth[:RESolution] 1 Hz to 10 MHz

This command sets the resolution bandwidth for spectrum represetation that was determined from the analog demodulation data.

The recording time required is calculated from the and the sampling rate indirectly set via ADEM:SPEC:SPAN:MAX or ADEM:BAND. If the available recording time is not sufficient for the given bandwidth, the recording time is set to ist maximum and the resolution bandwidth is enlarged to the resulting bandwidth.

Example:

```
"ADEM ON"                          ' Switches on the FM demodulator
"CALC:FEED 'XTIM:SPEC'             ' Switches on the result display RF spectrum
```

or

```
"CALC:FEED 'XTIM:FM:AFSP'          ' Switches on the result display AF spectrum
                                   'of FM
```

or

```
"CALC:FEED 'XTIM:RFP:AFSP'         'Switches on the result display AF spectrum
                                   'of RF power signal
"ADEM:BAND:RES 61.2kHz"            'Sets the resolution bandwidth to 61.2 kHz.
```

Characteristics: *RST value: 61.2 kHz
SCPI: device-specific

[SENSe:]ADEMod:SPECtrum:SPAN[:MAXimum] <numeric_value>

This command sets the maximum frequency range for displaying the RF spectrum that was determined from the FM demodulation data. The maximum span corresponds to the measurement bandwidth of analog demodulation (SENS:ADEM:BAND).

Demodulation bandwidth	Sampling rate	Comment
120 MHz	256 MHz	with FSQ-B72 only
50 MHz/85 MHz (1)	128 MHz	with FSQ-B72 only
30 MHz	64 MHz	with FSQ only
18 MHz	32 MHz	with FSQ only
10 MHz	32 MHz	
8 MHz	16 MHz	
5 MHz	8 MHz	
3 MHz	4 MHz	
1,6 MHz	2 MHz	
800 kHz	1 MHz	
400 kHz	500 kHz	
200 kHz	250 kHz	
100 kHz	125 kHz	
50 kHz	62.5 kHz	
25 kHz	31.25 kHz	
12.5 kHz	15.625 kHz	
6.4 kHz	7.8125 kHz	
3.2 kHz	3.90625 kHz	
1.6 kHz	1.953125 kHz	
800 Hz	976.5625 Hz	
400 Hz	488.28125 Hz	
200 Hz	244.140625 Hz	
100 Hz	122.0703125 Hz	

(1) The demodulation bandwidth at a sampling rate of 128 MHz depends on the center frequency that has been set. At a center frequency of =3.6 GHz, the demodulation bandwidth is 50 MHz; at higher center frequencies, it is 85 MHz.

Example:

```
"ADEM ON"                        'Switches on the FM demodulator
"CALC:FEED 'XTIM:SPEC'           'Switches on result display RF spectrum
"ADEM:SPEC:SPAN:MAX 5 MHz"       'Sets the max. span to 5 MHz

"ADEM:SPEC:SPAN:ZOOM 1 MHz"      'Sets the displayed span to 1 MHz
```

Characteristics: *RST value: 5 MHz
SCPI: device-specific

[SENSe:]ADEMod:SPECtrum:SPAN:ZOOM <numeric_value>

This command sets the frequency range for result display of RF spectrum determined from FM demodulation data. The frequency range for result display is limited to the maximum span (SENS:ADEM:SPEC:SPAN:MAX) or to the measurement bandwidth of analog demodulation (SENS:ADEM:BAND).

Example:

```
"ADEM ON"                          'Switches on the FM demodulator
"CALC:FEED 'XTIM:SPEC'             'Switches on result display RF spectrum"
"ADEM:SPEC:SPAN:MAX 5 MHz"         'Sets the maximum span to 5 MHz
"ADEM:SPEC:SPAN:ZOOM 1 MHz"        'Sets displayed span to 1 MHz
```

Characteristics: *RST value: 5 MHz
SCPI: device-specific

[SENSe:]ADEMod:SPECtrum[:TYPE] <result type 1>,<result type 2>,<result type 3>

This command selects the result types to be created in parallel by the RF SPECtrum measurement with active analog demodulation.

Parameters: <result type 1/2/3>.:

WRITe	The current measurement results will be obtained
AVERage	The measurement results will be averaged over the given # of measurements
MAXHold	The maximum result values will be obtained over the given # of measurements
MINHold	The minimum result values will be obtained over the given # of measurements
VIEW	The measurement results are frozen and displayed, i.e. they are not calculated for subsequent measurements.
OFF	The result type will not be used.

Notes:

Each value besides OFF can only be assigned to one result type at a time.
Together with other signals, a maximum of six traces can be activated simultaneously. For example, three FM and three PM result types can be activated simultaneously.

If all result types are set to OFF, switch off calculation of the AF spectrum

Examples:

```
ADEM:SPEC AVER,MAXH,MINH    'Creates average, max hold and min hold
                            'values at a time
ADEM:SPEC WRIT,OFF,OFF      'Only creates the current measurement values
ADEM:SPEC OFF,OFF,OFF       'Switches FM demodulation off
```

Characteristics: *RST values: OFF,OFF,OFF
SCPI: device-specific

[SENSe:]ADEMod:SPECtrum:RESult? <result type>

This command reads the result data obtained by RF SPECtrum measurement depending on the type indicated as a parameter. The data format of the output data block is defined by the FORMat command.

Note: *It is not possible to read out trace data when result type VIEW is selected.*

Parameters:

<result type>:	WRITe	The current measurement results will be obtained
	AVERage	The measurement results will be averaged over the given # of measurements
	MAXHold	The maximum result values will be obtained over the given # of measurements
	MINHold	The minimum result values will be obtained over the given # of measurements

Notes:

The result type indicated must be one of those configured by [SENSe:]ADEMod:SPEC[:TYPE]. Otherwise a query error will be generated.

Return Values:

ASCII Format (FORMat ASCII):

In this case the command will yield a list of comma separated values (CSV) of the measured values in floating point format. The output unit is dBm.

Binary Format (FORMat REAL,32):

In this case the command will yield binary data (Definite Length Block Data according to IEEE 488.2), each measurement value being formatted in 32 Bit IEEE 754 Floating-Point-Format. The schematics of the result string will be as follows:
#41024<value1><value2>...<value n>
with

#4	number of digits (= 4 in the example) of the following number of data bytes
1024	number of following data bytes (= 1024 in the example)
<value x>	4-Byte-Floating Point Value

Examples:

```
ADEM:SET 8MHz,32000,EXT,POS,-500,30  'Sets up demodulator parameters
ADEM:SPEC AVER,MAXH,MINH             'Sets up RF spectrum results
                                     'to measure
ADEM:SPEC WRIT,OFF,OFF               'Sets up AM results to measure
ADEM ON                              'Switches on demodulator
INIT;*WAI                            'Starts measurement and waits
                                     'for sync
FORM ASC                             'Selects output format
ADEM:SPEC:RES? AVER                  'Reads RF spectrum average
                                     'results
ADEM:SPEC:RES? MAXH                  'Reads RF spectrum max hold
                                     'results
ADEM:SPEC:RES? MINH                  'Reads RF spectrum min hold
                                     'results
ADEM:SPEC:RES? WRIT                  'Reads spectrum current results
```

Characteristics: *RST values: -
SCPI: device-specific

SENSe:BANDwidth Subsystem

This subsystem controls the setting of the analyzer's filter bandwidths. Both groups of commands (BANDwidth and BWIDth) perform the same functions.

COMMAND	PARAMETERS	UNIT	COMMENT
[SENSe<1|2>]			
:BANDwidth			
[:RESolution]	<numeric_value>	HZ	r
:AUTO	<Boolean>	--	
:DEMod	<numeric_value>	HZ	
:BWIDth			
[:RESolution]	<numeric_value>	HZ	
:AUTO	<Boolean>	--	
:DEMod	<numeric_value>	HZ	

[SENSe<1|2>:]BANDwidth|BWIDth[:RESolution] <numeric_value>

This command sets the IF bandwidth of the demodulator.

Analog resolution filters are available that are implemented as LC filters with four circuits (FSP) or 5 circuits (FSU/FSQ).

Instrument	IF bandwidth	Steps
FSP	300 kHz to 10 MHz	1,3,10
FSU	200 kHz to 10 MHz	1,2,3,5,10
FSQ	200 kHz to 50 MHz	1,2,3,5,10

If the resolution bandwidth is modified, coupling to the demodulation bandwidth is automatically switched off.

Example: `"BAND 1MHz"` Set IF bandwidth to 1 MHz

Characteristics: *RST value: - (AUTO is set to ON)
SCPI: conforming

[SENSe<1|2>:]BANDwidth|BWIDth[:RESolution]:AUTO ON | OFF

This command automatically couples the IF bandwidth to the demodulation bandwidth (BW_{RBW} = 10 * BW_{Demod}).

Example: `"BAND:AUTO OFF"` Switch off coupling of the IF bandwidth to the demodulation bandwidth

Characteristics: *RST value: ON
SCPI: conforming

[SENSe<1|2>:]BANDwidth|BWIDth:DEMod <numeric_value>

This command sets the bandwidth for analog demodulation. Depending on the selected demodulation bandwidth, the instrument selects the required sampling rate.

The available values of the demodulation bandwidths are determined by the sampling rates.

Rounded off demodulation bandwidth	Sampling rate	Comment
120 MHz	256 MHz	with FSQ-B72 only
50/85 MHz (1)	128 MHz	with FSQ-B72 only
30 MHz	64 MHz	with FSQ only
18 MHz	32 MHz	with FSQ only
10 MHz	32 MHz	
8 MHz	16 MHz	
5 MHz	8 MHz	
3 MHz	4 MHz	
1.6 MHz	2 MHz	
800 kHz	1 MHz	
400 kHz	500 kHz	
200 kHz	250 kHz	
100 kHz	125 kHz	
50 kHz	62.5 kHz	
25 kHz	31.25 kHz	
12.5 kHz	15.625 kHz	
6.4 kHz	7.8125 kHz	
3.2 kHz	3.90625 kHz	
1.6 kHz	1.953125 kHz	
800 Hz	976.5625 Hz	
400 Hz	488.28125 Hz	
200 Hz	244.140625 Hz	
100 Hz	122.0703125 Hz	

(1) The demodulation bandwidth at a sampling rate of 128 MHz depends on the center frequency that has been set. At a center frequency of =3.6 GHz, the demodulation bandwidth is 50 MHz; at higher center frequencies, it is 85 MHz

Example: `"ADEM:BAND:DEM 1MHz"` Set test bandwidth to 1 MHz

Characteristics: *RST value: 5 MHz
SCPI: device-specific

TRACe Subsystem

The TRACe subsystem controls access to the instrument's internal trace memory.

COMMAND	PARAMETERS	UNIT	COMMENT
TRACe<1|2> [:DATA]	TRACE1|TRACE2|TRACE3|TRACE4, <block>|<numeric_value>...	-	

TRACe<1|2>[:DATA] TRACE1| TRACE2| TRACE3, <block> | <numeric_value>

This command transfers trace data from the control computer to the instrument, the query reads trace data out of the instrument.

Note:
With active FM Demodulator (option FS-K7), only the trace data that are displayed are read out and reloaded. Part of the measured data that can be queried with the marker, however, is derived from the raw data. These measurement results are no longer available after reloading a trace, the query commands cause a query error.

Example:
```
"TRAC TRACE1,"+A$    (A$: Data list in current format)
"TRAC2? TRACE1"
```

Return values:

Scaling of the data is in the currently set level unit.

ASCII format (FORMat ASCII):

In this case, the command will return a list of comma separated values (CSV) of the measured values.

The number of test points is 501 (FSP) or 625 (FSU/FSQ).

Binary format (FORMat REAL,32):

In this case, the command returns binary data (Definite Length Block Data according to IEEE 488.2), with the measured values arranged in subsequent lists of I and Q data in 32-bit IEEE 754 floating point format. The response string will have the following structure:

FSP:	#42004<meas value 1><meas value value2>...<meas value 501>
FSU/FSQ:	#42500<meas value 1><meas value value2>...<meas value 625>
with	
#4	Number of digits in the following number of data bytes (= 4 in the example)
2004/2005	Number of the following data bytes *(# of DataBytes*, = 2004/2005 in the example)
<meas value x>	4-byte floating point value

Characteristics: *RST value: -
SCPI: conforming

The trace data is transferred in the current format (corresponding to the command FORMat ASCii|REAL). The device-internal trace memory is addressed using the trace names 'TRACE1' to 'TRACE3'.

The transfer of trace data from the control computer to the instrument takes place by indicating the trace name and then the data to be transferred. In ASCII format, this data consists of values separated by commas. If the transfer takes place using the REAL format (REAL,32), the data is transferred in block format.

The parameter of the query is the trace name TRACE1 to TRACE3, it indicates which trace memory will be read out.

Saving and recalling trace data together with the device settings to/from the device-internal hard disk or to/from a floppy is controlled via the commands "MMEMory:STORe:STATe" and "MMEMory:LOAD:STATe", respectively. Trace data is selected with "MMEMory:SELect[:ITEM]:ALL" or ""MMEMory:SELect[:ITEM]:TRACe". Trace data in ASCII format (ASCCII FILE EXPORT) is exported with the command "MMEM:STORe:TRACe".

The transfer format for the trace data depends on the instrument setting:
501 (FSP) or 625 (FSU and FSQ) results are output in the unit selected for display.

Note: *With AUTO PEAK detector, only positive peak values can be read out.*

FORMAT REAL,32 is to be used as format for binary transmission.

TRIGger Subsystem

The trigger subsystem is used to synchronize instrument actions with events. It is thus possible to control and synchronize the start of a sweep. An external trigger signal can be applied to the connector at the rear panel of the instrument.

COMMAND	PARAMETERS	UNIT	COMMENT
TRIGger<1|2>			
[:SEQuence]			
:SOURce	IMMediate | EXTernal | VIDeo | IFPower | RFPower | TV | AF | AM | FM		TV, RFPOWer only with option FSP-B6 AF with option FS-K7
:LEVel			
:AM	<numeric_value>	DBM	Option FS-K7 FM demodulator
:FM	<numeric_value>	HZ	Option FS-K7 FM demodulator
:IFPower	<numeric_value>	DBM	without Option FS-K7 FM Demodulator
:RFPower	<numeric_value>	DBM	Option FSP-B6 TV and RF trigger
:VIDeo	<numeric_value>	PCT	
:HOLDoff	<numeric_value>	S	
:SLOPe	POSitive|NEGative	--	

TRIGger<1|2>[:SEQuence]:SOURce IMMediate | EXTernal | VIDeo | IFPower | RFPower | TV | AF | AM | AMR | FM | PM

This command selects the trigger source for the start of a sweep:

Notes: *This command is not available during GSM measurements. The trigger source selection has to be done with the command TRIGger<1|2>[:SEQuence]:SYNChronize:ADJust.*

The selection of RFPower and TV is only possible with option FSP-B6 (TV and RF-Trigger).

Parameters:

IMMediate = Automatic triggering of the next measurement at the end of the previous one. The parameter corresponds to the FREE RUN setting.

EXTernal = The next measurement is triggered by the signal at the external trigger input

VIDeo = The next measurement is triggered by the detection of a signal at the video filter output. VIDeo cannot be selected if the FM demodulator is active.

IFPower = The next measurement is triggered by the detection of a signal at the instrument IF (10 MHz bandwidth). I

RFPower = The next measurement is triggered by the detection of a signal at the instrument RF (80 MHz bandwidth).

TV = The next measurement is triggered by the detection of a TV signal according to the settings of the `TRIGger:SEQuence:VIDeo-` subsystem. TV cannot be selected if the FM demodulator is active.

AF = FM — The next measurement is triggered on detection of an FM modulated signal (equivalent to 'FM')

AMR = The next measurement is triggered on detection of an audio signal after AM demodulation

AM = The next measurement is triggered on detection of an RF signal in the time domain.

PM = The next measurement is triggered on detection of an audio signal after PM demodulation

Note: *For triggering with the AF, AM and FM trigger sources to be successful, the measurement time must cover at least 5 periods of the audio signal.*

Example: `"TRIG:SOUR EXT"` Select the external trigger input as source for the trigger signal

Characteristics: *RST value: IMMediate
SCPI: conforming

TRIGger<1|2>[:SEQuence]:LEVel:AM[:ABSolute] -100...+30dBm

This command sets the level when AM modulated signals are used as trigger source.

Note: *For triggering with the AF, AM and FM trigger sources to be successful, the measurement time must cover at least 5 periods of the audio signal.*

Example: "TRIG:LEV:AM -30 dBm" Set the AM trigger threshold to -30 dBm

Characteristics: *RST value: -20 dBm
SCPI: device-specific

TRIGger<1|2>[:SEQuence]:LEVel:AF -10...+10MHz
TRIGger<1|2>[:SEQuence]:LEVel:FM -10...+10MHz

This command sets the level when FM modulated signals are used as trigger source.

Example: "TRIG:LEV:AM 10 kHz" Set the FM trigger threshold to 10 kHz

Characteristics: *RST value: 0 Hz
SCPI: device-specific

TRIGger<1|2>[:SEQuence]:LEVel:PM -1000...+1000RAD

This command sets the phase when PM-modulated signals are used as a trigger source.

Note: *For triggering with the AF, AM, AMR, PM and FM trigger sources to be successful, the measurement time must cover at least five periods of the audio signal*

Example: `"TRIG:LEV:PM 1.2 RAD"` Set the PM trigger threshold to 1.2 rad

Characteristics: *RST value: 0 RAD
SCPI: device-specific

TRIGger<1|2>[:SEQuence]:LEVel:IFPower -30...-10DBM

This command sets the level for the IF power trigger source.

Example: `"TRIG:LEV:IFP -20DBM"`

Characteristics: *RST value: -20 DBM
SCPI: device-specific

TRIGger<1|2>[:SEQuence]:LEVel:RFPower -50...-10DBM

This command sets the level for the RF power trigger source.

Example: `"TRIG:LEV:RFP -20DBM"`

Characteristics: *RST value: -20 DBM
SCPI: device-specific

This command is only available in conjunction with option TV and RF-Trigger FSP-B6.

TRIGger<1|2>[:SEQuence]:HOLDoff -100...+100s

This command defines the length of the trigger delay.

Example: `"TRIG:HOLD 500us"`

Characteristics: *RST value: 0s
SCPI: conforming

TRIGger<1|2>[:SEQuence]:SLOPe POSitive|NEGative

This command selects the slope of the trigger signal. The selection of the trigger slope is valid for all trigger signal sources.

Example: `"TRIG:SLOP NEG"`

Characteristics: *RST value: POSitive
SCPI: conforming

UNIT Subsystem

The UNIT subsystem defines the units of the parameters to be set and measurement results.

COMMAND	PARAMETERS	UNIT	COMMENT
UNIT :ANGLe	DEG | RAD		

UNIT:ANGLe DEG | RAD

This command selects the unit for angles.

Example: "UNIT:ANGL DEG"

Characteristics: *RST value: RAD
SCPI: conforming

Table of Softkeys and Hotkeys including Assignment of Remote-Control Commands

This chapter contains the assignment of the remote-control commands to those softkey menus that differ from the base unit with regard to the FM demodulator option. The operating manual of the base unit covers the assignment of the unchanged menus.

FM Demodulator Main Menu

FM DEMOD	
FM DEMOD ON OFF	INST:SEL ADEM INST:NSEL 3
RESULT DISPLAY	---
FM	CALC:FEED 'XTIM:FM'
RM	CALC:FEED 'XTIM:PM'
AM	CALC:FEED 'XTIM:AM:REL'
RF POWER	CALC:FEED 'XTIM:RFP'
RF SPECTRUM	CALC:FEED 'XTIM:SPECTRUM'
AF SPECTRUM	CALC:FEED 'XTIM:FM:AFSP' CALC:FEED 'XTIM:PM:AFSP' CALC:FEED 'XTIM:AM:REL:AFSP' CALC:FEED 'XTIM:RFP:AFSP'
SELECT TRACE	---
DIAGRAM FULL SIZE	DISP:WIND:SIZE LARG
RANGE	---
DEVIATION PER DIV	DISP:WIND:TRAC:Y:PDIV 50kHz
REFERENCE POSITION	DISP:WIND:TRAC:Y:RPOS 50PCT
REFERENCE VALUE	DISP:WIND:TRAC:Y:RVAL 0HZ
AF COUP AC DC	SENS:ADEM:AF:COUP DC
ZERO PHASE REF POS	SENS:ADEM:PM:RPO:X 10us

DEVIATION LIN LOG	DISP:WIND:TRAC:Y:SPAC LOG
DB PER DIV	DISP:WIND:TRAC:Y:PDIV 5DB
PHASE WRAP ON OFF	CALC:FORM PHAS
UNIT	---
PM UNIT RAD DEG	UNIT:ANGL DEG
MAX DISP RF POWER	DISP:WIND:TRAC:Y:RVAL 10 DBM
RANGE LINEAR	
RANGE LINEAR %	DISP:WIND:TRAC:Y:SPAC LIN
RANGE LINEAR DB	DISP:WIND:TRAC:Y:SPAC LDB
RANGE LOG MANUAL	DISP:WIND:TRAC:Y:SPAC LOG DISP:WIND:TRAC:Y:SCALe <num_value>
RF POWER LOG LIN	DISP:WIND:TRAC:Y:SPAC LOG
RF POWER PER DIV	DISP:WIND:TRAC:Y:PDIV 10 DB
FREQUENCY SPAN	ADEM:SPEC:SPAN 5 MHz
RES BW	ADEM:SPEC:BAND:RES 10 kHz
DEMOD BW	SENS:BAND:DEM 10MHz
MEAS TIME	SENS:ADEM:MTIM 62.5US ..... SENS:SWE:TIME 62.5US
ZOOM	SENS:ADEM:ZOOM ON ..... SENS:ADEM:ZOOM:STARt 30US

FREQ Key

CENTER	[SENSe:]FREQuency:CENTer <num_value>
CF-SREPSIZE	
0.1 * SPAN	[SENSe:]FREQuency:CENTer:STEP:LINK SPAN; [SENSe:]FREQuency:CENTer:STEP:LINK:FACTor 10PCT
0.5 * SPAN	[SENSe:]FREQuency:CENTer:STEP:LINK SPAN; [SENSe:]FREQuency:CENTer:STEP:LINK:FACTor 50PCT

X * SPAN	[SENSe:]FREQuency:CENTer:STEP:LINK SPAN; [SENSe:]FREQuency:CENTer:STEP:LINK:FACTor <num_value>
0.1 * RBW	[SENSe:]FREQuency:CENTer:STEP:LINK RBW; [SENSe:]FREQuency:CENTer:STEP:LINK:FACTor 10PCT
0.5 * RBW	[SENSe:]FREQuency:CENTer:STEP:LINK RBW; [SENSe:]FREQuency:CENTer:STEP:LINK:FACTor 50PCT
X * RBW	[SENSe:]FREQuency:CENTer:STEP:LINK RBW; [SENSe:]FREQuency:CENTer:STEP:LINK:FACTor <num_value>
= CENTER	without function in IEC/IEEE-bus mode
= MARKER	without function in IEC/IEEE-bus mode
MANUAL	[SENSe:]FREQuency:CENTer:STEP <num_value>
AF CENTER	[SENSe:]ADEMod:AF:CENTer <num_value>
AF START	[SENSe:]FREQuency:STARt <num_value>
AF STOP	[SENSe:]FREQuency:STOP <num_value>

SPAN Key

AF SPAN	[SENSe:]ADEMod:AF:SPAN <num_value>
FREQUENCY SPAN	[SENSe:]ADEMod:SPECtrum:SPAN:ZOOM
AF FULL SPAN	[SENSe:]ADEMod:AF:SPAN FULL
FULL SPAN	[SENSe:]ADEMod:SPECtrum:SPAN:ZOOM MAX
DEMOD BW	SENS:BAND:DEM 10MHz
MEAS TIME	SENS:ADEM:MTIM 62.5US ..... SENS:SWE:TIME 62.5US

AMPT Key

REF LEVEL	DISPlay[:WINDow<1|2>]:TRACe<1...3>:Y[:SCALe]:RLEVel <num_value>
RANGE LINEAR	
RANGE LINEAR %	DISPlay[:WINDow<1|2>]:TRACe<1...3>:Y:SPACing LINear

RANGE LINEAR DB	DISPlay[:WINDow<1|2>]:TRACe<1...3>:Y:SPACing LDB
RANGE LOG 100 dB	DISPlay[:WINDow<1|2>]:TRACe<1...3>:Y:SPACing LOGarithmic; DISPlay[:WINDow<1|2>]:TRACe<1...3>:Y[:SCALe] 100 dB
RANGE LOG MANUAL	DISPlay[:WINDow<1|2>]:TRACe<1...3>:Y:SPACing LOGarithmic; DISPlay[:WINDow<1|2>]:TRACe<1...3>:Y[:SCALe] <num_value>
RF ATTEN MANUAL	INPut:ATTenuation <num_value>
RF ATTEN AUTO	INPut:ATTenuation:AUTO ON
REF LEVEL POSITION	DISPlay[:WINDow<1|2>]:TRACe<1...3>:Y[:SCALe]:RPOSition <num_value>
REF LEVEL OFFSET	DISPlay[:WINDow<1|2>]:TRACe<1...3>:Y[:SCALe]:RLEVel:OFFSet <num_value>
EL ATTEN AUTO	INPut:EATT:AUTO ON (only with option FSP-B25)
EL ATTEN MANUAL	INPut:EATT <num_value> (only with option FSP-B25)
EL ATTEN OFF	INPut:EATT:STATe OFF (only with option FSP-B25)
RF INPUT 50Ω 75Ω	INPut:IMPedance 50 | 75

BW Key

RES BW	ADEM:SPEC:BAND:RES 10 kHz
IF BW AUTO	BAND:RES:AUTO ON
IF BW MANUAL	BAND:RES 1 MHz
DEMOD BW	SENS:BAND:DEM 10MHz
MEAS TIME	SENS:ADEM:MTIM 62.5US ..... SENS:SWE:TIME 62.5US

TRIG Key

FREE RUN	TRIG:SOUR IMM
DEMOD SIGNAL	---
FM SIGNAL	TRIG:SOUR FM TRIG:LEV:FM 10 kHz
RM SIGNAL	TRIG:SOUR PM TRIG:LEV:PM -1 rad
AM SIGNAL	TRIG:SOUR AMR TRIG:LEV:AM:REL 30 PCT
RF POWER SIGNAL	TRIG:SOUR AM TRIG:LEV:AM:ABS -30 dBm
EXTERN	TRIG:SOUR EXT SWE:EGAT:SOUR EXT
IF POWER	TRIG:SOUR IFP TRIG:LEV:IFP -20 dBm
RF POWER	TRIG:SOUR RFP TRIG:LEV:RFP -40 dBm
TRIGGER OFFSET	TRIG:HOLD 10US
POLARITY POS NEG	TRIG:SLOP POS

MKR Key

MARKER 1..4	CALCulate<1|2>:MARKer<1...4>[:STATe] ON | OFF; CALCulate<1|2>:MARKer<1...4>:X <numeric value>; CALCulate<1|2>:MARKer<1...4>:Y? CALCulate<1|2>:DELTamarker1[:STATe] ON | OFF; CALCulate<1|2>:DELTamarker<1...4>:X <numeric value>; CALCulate<1|2>:DELTamarker<1...4>:Y?
MARKER NORM DELTA	CALCulate<1|2>:DELTamarker<1...4>[:STATe] ON | OFF;
ALL MARKER OFF	CALCulate<1|2>:MARKer<1...4>:AOFF CALCulate<1|2>:DELTamarker<1...4>:AOFF

MKR ⇒ Key

SELECT MARKER	without function in IEC/IEEE-bus mode
PEAK	CALCulate<1|2>:MARKer<1...4>:MAXimum[:PEAK] CALCulate<1|2>:DELTamarker<1...4>:MAXimum[:PEAK]
REF LEVEL = MKR LVL	CALCulate<1|2>:MARKer<1...4>:FUNCtion:REFerence

NEXT PEAK	CALCulate<1|2>:MARKer<1...4>:MAXimum:NEXT CALCulate<1|2>:DELTamarker<1...4>:MAXimum:NEXT
NEXT PEAK RIGHT	CALCulate<1|2>:MARKer<1...4>:MAXimum:RIGHt CALCulate<1|2>:DELTamarker<1...4>:MAXimum:RIGHt
NEXT PEAK LEFT	CALCulate<1|2>:MARKer<1...4>:MAXimum:LEFT CALCulate<1|2>:DELTamarker<1...4>:MAXimum:LEFT
MKR-> TRACE	CALCulate<1|2>:MARKer<1...4>:TRACe <numeric value> CALCulate<1|2>:DELTamarker<1...4>:TRACe <numeric value>
MIN	CALCulate<1|2>:MARKer<1...4>:MINimum[:PEAK] CALCulate<1|2>:DELTamarker<1...4>:MINimum[:PEAK]
MIN NEXT	CALCulate<1|2>:MARKer<1...4>:MINimum:NEXT CALCulate<1|2>:DELTamarker<1...4>:MINimum:NEXT
NEXT MIN RIGHT	CALCulate<1|2>:MARKer<1...4>:MINimum:RIGHt CALCulate<1|2>:DELTamarker<1...4>:MINimum:RIGHt
PEAK EXCURSION	CALCulate<1|2>:MARKer<1...4>:PEXCursion <num_value>

MKR FCTN Key

SELECT MARKER	without function in IEC/IEEE-bus mode
PEAK	CALCulate<1|2>:MARKer<1...4>:MAXimum[:PEAK] CALCulate<1|2>:DELTamarker<1...4>:MAXimum[:PEAK]
MKR-> TRACE	CALCulate<1|2>:MARKer<1...4>:TRACe <numeric value> CALCulate<1|2>:DELTamarker<1...4>:TRACe <numeric value>

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Note: *The softkeys are listed alphebetically under the keyword "Softkey".*

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